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No. 11.—Vol. 13.
May, 1893.

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Wisdom is humble that he knows no more.'—COWPER.

VOL. XIII. NO. 11. MAY, 1893. PRICE, 6D. POST FREE, 8D.

WELL-KNOWN TEACHERS AT WORK.

XIX. MR. T. P. SYKES,

Great Horton Board School, Bradford.

IT is impossible for anyone interested in schools and educational matters to visit a school without learning something. The visitor sees something to copy or to avoid, and especially is this so when he happens to be practically engaged in teaching. Though I have had opportunities of visiting many schools, and of observing methods of instruction, apparatus, &c., I felt that in the Great Horton Mixed Board School I should find some points of special interest. I was not disappointed. Things were up to date. The old is giving way to the new as common sense and expediency dictate. There is a true spirit of progress in the school, and everything about it bears the mark of efficiency and attractiveness.

Mr. Sykes, the head master, is a man of few words, but when he speaks he says something worth listening to; and he says this something with force and clearness. He is a man of decision and earnestness, and he is just the man for managing a large school.

The Great Horton Board School is situated about two miles from the centre of Bradford. A branch line of the Great Northern Railway runs from Bradford to Halifax, and the Great Horton Station is on this line. The school is a few minutes' walk from the station.

Mr. T. P. Sykes was born at Mirfield in the year 1855. He attended the Wesleyan Day School, under Mr. N. H. Osborne, as a scholar, pupil teacher, and assistant-master until he entered the Westminster Training College in 1874. He was No. 51 on the Scholarship list for England and Wales Christmas 1873, and headed the College list on the Government Certificate Examination at the end of his first year's training, and stood second on the list at the end of his second year's training.

For three years after leaving college he had charge of the Wesleyan Day School at the ancient seaside town of Deal, in Kent. From there he was appointed science master at the non-Government Wesleyan High School at Bradford, which only had an existence of three years. Thence he removed to Rochdale, and acted as first assistant under Mr. R. Greenwood, at the Wesleyan School, Union Street, one of the largest and most flourishing voluntary schools in the country. Whilst here he matriculated First Class at the London University. On March 1st 1884 he was appointed to the head-mastership of the Great Horton Boys' Board School, under the Bradford School Board. In 1886 the school was transferred to the present mixed school, which was opened by Sir H. Holland, Vice-President of the Council, and Mr. Sykes was appointed head master.

Surrounding the school is a very spacious playground, of which a portion is covered. The building is of the most modern construction. It has a large central hall measuring 88 feet by 45 feet, and twelve class-rooms—each fitted with desks and separate seats with backs. Eight of the class-rooms accommodate fifty-six scholars each, whilst the remaining four are fitted for sixty-four scholars each, thus providing for 704 scholars. The cloak-rooms and lavatories are commodious. There are at present 850 scholars—boys and girls—on the books, including about 200 factory half-timers, with an average attendance of 700. All standards are taught in the school.

There is thus a combination of boys and girls and half-timers, which taxes Mr. Sykes' powers of organization to the utmost. In the work of the school he has the help of twelve assistant-teachers and four juniors, the latter of whom attend school half a day, being at the central classes for junior teachers the other half day. The relations between Mr. Sykes and his staff are marked by the utmost cordiality and good will. This feature has been noticed by Her Majesty's inspector, who, on visiting the school without notice, remarked on leaving, 'Your teachers all seem to be very enthusiastic about their work.'

On entering the school one is struck by its light and airy appearance. It seems impossible for any

vitiated air to collect either in the main room or in the class-rooms.

It was a fine sight to see, on the morning of my visit, about 400 boys and girls of the upper standards going through their physical exercises in the central hall to the music of the piano. I was informed that this takes place every day, and that the piano accompaniment is sometimes strengthened by two or three violins played by boys.

The main room is not used for ordinary teaching purposes, being kept for assembling, drill, and a few special lessons and examinations. In the centre of the floor of the main room the points of the compass are marked out. Around this is the plan of the school accurately laid down in ink to the scale of an inch to a foot. The teacher of Standard I. is provided with sufficient inch cubes of wood to set out the whole plan. The children gather round it in a circle and place the cubes under the teacher's direction. A little to one side is an accurately drawn plan of the streets within a radius of about a mile round the school. Then we come to a map of Bradford and district, including all the towns and villages within a radius of about twelve miles from Bradford. A step in advance of this is the map of the British Isles marked out on the floor according to the points of the compass. Then, for the special benefit of Standard IV. children there is a full-sized square pole showing the divisions into thirty and a quarter square yards.

During the summer season the scholars bring trip bills to school. They are neatly fastened on the wall, and each one is made the foundation of many interesting questions.

At one end of the school is a well-filled *Museum-case*. British manufactures in their various stages are well illustrated—wool, cotton, soap, matches, linen, silk, knives, candles, glass, &c.—besides a miscellaneous collection of interesting and curious articles, many of them having been brought by the scholars themselves, and others having been provided by the teachers or sent by various manufacturers. Besides the central museum cupboard there are half-a-dozen off-shoots in the shape of class museums in as many different class-rooms, to illustrate the special science lessons given there.

There is a *Library* of about three hundred volumes, a third of which has been provided by the School Board; the remainder have been gathered together by the teachers themselves. The books are divided into six groups, and located in as many different rooms. The batches of books change rooms periodically. They thus come into closer contact with the children, and are more largely used than they would be if kept in a central cupboard.

Mr. Sykes has introduced a thorough *system of superintending the classes* and of testing their work. He has five thorough examinations in the course of each school year—two in the first half and three in the second half. It is not his plan to be continually pulling up the plants by the roots in order to see how they are growing. Two months' work for each class is agreed upon by consultation with the teacher. At the end of that time comes a thorough examination of each class in every subject. Each teacher keeps two books. One book contains the scheme of work, with notes of lessons and practical hints for working the class. The other is the Report book; every subject is reported on in full. The work of examining the whole school occupies between three weeks or a month.

Extract from a Report Book.

Standards VI., VII. Day scholars—Boys and girls. Miss ——, *Teacher.*

Arithmetic.—Standard VI. Boys and girls :—

Result : Sums right	4	3	2	0
Children	10	1	5	2

Average 2·9 right per child.

More than half the children had every sum right. The two failures bring down the average.

Arithmetic.—Standard VII. Boys and girls :—

Result : Sums right	4	3	2
Children	9	3	1

Average 3·6 per child.

The work in this Standard was remarkably well done. There is a very high average. On the whole the sums were nicely put down. On one or two papers the work was not quite up to the mark.

In mental arithmetic the class did very well. Twelve questions were given on paper. The results were very good. The children answer smartly when questioned orally.

Writing.—VI., VII. Composition by part of the class on subjects previously prepared by object lessons.

Mark	E	G	F
Children	5	11	4

Dictation to the remainder from the daily paper.

Mistakes	0	1	2	3
Children	4	5	1	1

Average ·9 mistakes per child.

The dictation was remarkably well done. The handwriting on all the papers was generally very good. The composition was not quite up to former Standard. In some papers there were a number of commonplace, almost meaningless, sentences—packing.

Reading.—

Mark	E	G	F	O
Children	21	8	1	1

The reading is a very commendable feature of the work of this class. The children enter into the spirit and meaning of the matter read with intelligence. The reading of a good many of the children is very pleasing to listen to, both as regards voice and style. Good use has evidently been made of the volumes in the class library.

Recitation.—The whole of the lines—150—were known and repeated. The children should be encouraged to repeat the whole piece with proper gestures and expression individually. The majority of the children say it remarkably well. Questions are well answered on the whole. In a passage near the end the children were not quite so successful.

Grammar.—Analysis is excellent. The children understand the various parts of a sentence, and the kinds of sentences. They show encouraging signs of balancing ideas in their minds. Parsing is very good. Illustrative sentences are well made. The list of prefixes is rather meagre. The children know these well, and give good examples.

General Remarks.—Tone and discipline are excellent. The work throughout is thoroughly sound and good. The individuality of the boys and girls is not repressed, but is encouraged. The class reflects great credit on the teacher.

May 25, 1892. T. P. SYKES.

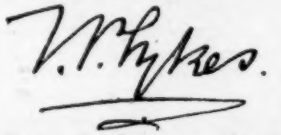
After each periodical examination of the classes a conference of the staff is called, where the results arrived at are discussed, and weak points noted. There is no striving for a dead uniformity in every class. The individuality of every teacher is encouraged. Each teacher knows that he or she will receive full credit for every original idea or method for improving the work of the class.

There is nothing of the martinet discipline in Mr. Sykes' school. It is tone, rather than military discipline, that is aimed at. The best kind of discipline does not show itself in outward movements, but in the attitude of the mind. The best praise that Mr. Sykes can award to any class is, that the children seem anxious to learn, that their minds are alert, and they take trouble to grasp the meaning of a question put to them.

It is a remarkable thing that, in a mixed school like this under a master, the sewing of the girls has invariably received special mention at the hands of H.M. Inspector. The Board's superintendent of needlework also always speaks in terms of the highest praise of the work done.

This is accounted for in no other way than by the heartiness with which the lady teachers go about their work. It is a sample of the spirit which pervades the school.

Mr. Sykes is a firm believer in the *Pupil Teacher system* under reasonable conditions. If any profession or business requires an apprenticeship, it is that of teaching. There is so much to be learnt that can only come by experience. He is delighted with the results of the Central Classes half-day system, as it exists under the Bradford Board. The junior teachers, under that system, can lead something of the life of ordinary mortals, instead of a hard day in school followed by hours of study at home, enough to ruin any constitution. He finds the juniors work conscientiously and well during the half day at school. They put more intelligent energy into their labours than was possible under the old system.



Each junior teacher gives a *criticism lesson* once a month before him and two or three other teachers. It is well prepared. The Notes of Lessons Book, containing notes for the lesson, is handed to him. When the lesson is over the teachers criticise it, and in addition Mr. Sykes writes a detailed criticism in the Notes of Lessons Book, both on the notes and the manner in which the lesson has been given. By the time a junior teacher has finished his apprenticeship, he has a valuable series of notes of lessons, with a detailed criticism on each lesson in writing. These are useful for reference in after years. Each junior teacher gives a lesson to every Standard in the school in the course of a year. Mr. Sykes finds that the junior teachers take a pride in giving good lessons, and making full preparations for experiments.

In elementary science Mr. Sykes has moved with caution. The course for Standards I. and II. consists in a series of thirty object lessons for each Standard. Short notes on each subject have been drawn up, showing the ground covered by each lesson. The series has been published in a little manual, entitled Topics for Lessons.

The lessons in Standard III. are on the elementary forces of nature. Gravity, attraction of all bodies for each other, magnetism, electricity, with a few miscellaneous lessons illustrated by chemical experiments. Each lesson is drawn up on the principle of experiment, observation, deduction.

For the present the children of Standard IV. and upwards take up English according to a modified scheme approved by H.M. Inspector, instead of elementary science.

Object lessons again come to the fore in teaching composition to Standards VI. and VII. H.M. Inspector has agreed that the half-timers of those Standards shall prepare twenty subjects in the course of the year—the day-scholars forty subjects. The composition is tested from these subjects. This method brings the matter within manageable limits. Nothing like a stereotyped form of expression is aimed at. Notes are drawn up of each lesson given. As the school contains such a large number of half-timers, the various concessions which have been made at different times have been much appreciated. The half-timers of Standards VI. and VII. learn 100 lines of poetry instead of the 150 required by the Code.

In Geography, Standards V., VI., and VII. are grouped, and a modified scheme is taken. In Europe, for example, the half-timers are expected to have a general knowledge of the Continent, with a particular knowledge only of the British Isles, France, Germany, Italy, Russia, Switzerland, and Belgium.

As indicative of the standing of the school in the estimation of H.M. Inspector, it is sufficient to state that twice during the last four years the school has been awarded the highest grants without examination.

There is a branch of the Yorkshire Penny Bank connected with the school. During last year there were 7,000 transactions. £266 4s. 1d. was deposited by the children; £97 18s. 7d. was repaid to the children; £86 was transferred to the central bank to bear interest at 3 per cent.; and £81 5s. 6d. is standing to the credit of the children. The bank is open from 1 p.m. to 2 p.m. every Monday. It is carried on by Mr. Sykes and his principal assistant.

Mr. Sykes carries his activities outside school work. Having a large number of half-timers in his school, he was one of those who undertook the resuscitation of the Half-time Council of Teachers in

1889 at Manchester. He took office as Secretary of the Council; and in December of that year there appeared a forcible article from his pen in the *Fortnightly Review* on 'The Factory Half-timer.' It is not too much to say that this article, and the press comments on it, drew general attention to the subject, and contributed to the reforms in the Code on the matter. Previous to that, the existence of the factory half-timer, burdened by half-a-day's work in a heated factory, and then expected to do exactly the same amount of school-work in the remaining half-day as the more fortunate day-scholar did in a whole day, was totally ignored by the Education Department.

In discussing that article, the *Preston Evening Post* said:—

'It would be difficult to speak in terms of excessive commendation of the article on "The Factory Half-timer" which Mr. T. P. Sykes contributes to the *Fortnightly Review* for December. Elizabeth Barrett Browning did not give ear to "the cry of the children" with a more tender yearning to help those who cannot help themselves than Mr. Sykes has done.'

Following up the work, then begun, he has laboured both in the press and on the platform to bring about a better condition of things. He was the leader of a movement, started in Bradford, for procuring the total abolition of the half-time system. He has shown considerable courage in attacking the system in the columns of the Daily Press.

He has held the offices of Secretary, Vice-president, and President of the Bradford and District Teachers' Association, and has been chosen to represent the Association on several occasions at the Annual Conference of the N. U. T. At present, he is the Press Secretary and Editor of the Bradford *Quarterly Circular*.

Whilst he holds the members of the Executive in great admiration for the large amount of unselfish and sterling service they have done to the profession at large, yet he is strongly opposed to them on one line of policy, as is shown by newspaper reports and his letters to the press. That is, on the proposition of the Executive to set up an attendance qualification for school exemption. It is a policy which he will vigorously oppose to the end; and in this he has the support of the Bradford Association, which is almost unanimous in its condemnation of the policy of the Executive.

Mr. Sykes objects to this attendance scheme on principle. He holds strongly that children should not come to school for the purpose either of passing a Standard or making attendances. One is as vicious as the other. The idea of education is thrust completely into the background by either proposal. Again, no minimum of attendances can be fixed upon which would be fair for the country throughout. In country districts where children have miles of road, covered by snow and mud, to pass to reach school, they cannot be expected to attend as regularly as town children, all of whom live almost within a stone's throw of the school. Parliament, in fixing the minimum, would be bound to have an eye for what could be reasonably accomplished by the children most unfavourably situated. The system would also play into the hands of those magistrates who have no sympathy with the enforcement of school attendance. They would refuse to punish a boy, who attended irregularly, at nine years of age because they would say that a punishment for the same offence, in the shape of a year's longer attendance at the school, was held over his head, when he reached thirteen years of age. Then there is the enormous difficulty of registering attendances, and supplying certificates of attendance in the midst of a shifting population. All this work the Executive proposes to throw on the shoulders of teachers without fee or reward.

It is nothing more nor less than the Child's School Book back again, and how the Executive can look with equanimity upon that proposal is more than he can conceive.

Mr. Sykes is a *musician* to his finger tips. On the occasion of my visit he had just resumed work after a week's leave of absence as a chorus singer in the Leeds Triennial Musical Festival. He was full of the glories of that festival. It is one of his great aims to encourage genuine musical taste among his scholars. He argues that much that a child learns at school will be forgotten in after years, but if he has had implanted in him a taste for good music he has one of the most valued possessions of a lifetime. That being so, he goes into the work enthusiastically. A rule from which he never deviates is that every class in the school shall have a little musical practice every day in addition to the one set lesson a week according to the time-table.

Mr. Sykes does not compare the Tonic Sol-Fa and the Staff Notation with the idea of setting one above the other. He looks upon the Tonic Sol-Fa method

TIME TABLE, 1892-3. BRADFORD SCHOOL BOARD.—GREAT HORTON SCHOOL.—MIXED DEPARTMENT.

MORNING.

Standard.	9—9.20.	9.20—9.35.	9.35—9.45.	9.45—10.15.	10.15—11.	11—11.15.	11.15—12.		Day.
VI. & VII., D.S.	Scripture.	Examining Hair, Attire, &c.	Registers Marked and Closed.	Arithmetic	Reading	Recreation.	Writing, C.B.		Monday.
VI. & VII., H.T.				Arithmetic	Reading		Writing, C.B.		
V., D.S.				Arithmetic	Reading		Writing, C.B.		
V., H.T.				Arithmetic	Reading		Writing, C.B.		
IV., B. & G.				Arithmetic	Reading		Writing, C.B.		
III., B. & G.				Arithmetic	Reading		Writing, C.B.		
II., B. & G.				Arithmetic	Reading		Writing, C.B.		
I., B. & G.				Arithmetic	Reading		Writing, C.B.		
VI. & VII., D.S.				Arithmetic	Reading		Geography (Boys)	Needlework (Girls)	Tuesday.
VI. & VII., H.T.				Arithmetic	Reading		Geography (Boys)		
V., D.S.				Arithmetic	Reading		Geography (Boys)		
V., H.T.				Arithmetic	Reading		Geography (Boys)		
IV., B. & G.				Arithmetic	Reading		Geography (Boys)		
III., B. & G.				Arithmetic	Reading		Geography (Boys)		
II., B. & G.				Arithmetic	Reading		Geography (Boys)		
I., B. & G.				Arithmetic	Reading		Geography (Boys)		
VI. & VII., D.S.				Arithmetic	Reading		Writing		Wednesday.
VI. & VII., H.T.				Arithmetic	Reading		Writing		
V., D.S.				Arithmetic	Reading		Writing		
V., H.T.				Arithmetic	Reading		Writing		
IV., B. & G.				Arithmetic	Reading		Writing		
III., B. & G.				Arithmetic	Reading		Writing		
II., B. & G.				Arithmetic	Reading		Writing		
I., B. & G.				Arithmetic	Reading		Writing		
VI. & VII., D.S.				Arithmetic	English	Criticism Lessons.	Writing		Thursday.
VI. & VII., H.T.				Arithmetic	English		Writing		
V., D.S.				Arithmetic	English		Writing		
V., H.T.				Arithmetic	English		Writing		
IV., B. & G.				Arithmetic	English		Writing		
III., B. & G.				Arithmetic	Science		Writing		
II., B. & G.				Arithmetic	Science		Writing		
I., B. & G.				Arithmetic	Science		Reading		
VI. & VII., D.S.				Arithmetic	Writing		Drawing (Boys)	Needlework (Girls)	Friday.
VI. & VII., H.T.				Arithmetic	Writing		Drawing (Boys)		
V., D.S.				Arithmetic	Writing		Drawing (Boys)		
V., H.T.				Arithmetic	Writing		Drawing (Boys)		
IV., B. & G.				Arithmetic	Reading		Drawing (Boys)		
III., B. & G.				Arithmetic	Reading		Drawing (Boys)		
II., B. & G.				Arithmetic	Reading		Drawing (Boys)		
I., B. & G.				Arithmetic	Reading		Drawing (Boys)		

AFTERNOON.

Standard.	2—15.	2.15—3.		3—3.45.		3.45—4.25.		4.25—4.30.	Day.
VI. & VII., D.S.	Scholars' Attire, &c.	Arithmetic		Reading		Writing		Assembling and Dismissing in Principal Rooms.	Monday.
VI. & VII., H.T.		Arithmetic		Reading		Writing			
V., D.S.		Arithmetic		Reading		Writing			
V., H.T.		Arithmetic		Reading		Writing			
IV., B. & G.		Arithmetic		Reading		Writing			
III., B. & G.		Arithmetic		Reading		Writing			
II., B. & G.		Arithmetic		Reading		Writing			
I., B. & G.		Arithmetic		Reading		Writing			
VI. & VII., D.S.		Algebra, B.	Needlework (Girls)	Reading		Writing			Tuesday.
VI. & VII., H.T.		Geography, B.		Reading		Arithmetic			
V., D.S.		Algebra, B.		Reading		Writing			
V., H.T.		Geography, B.		Reading		Arithmetic			
IV., B. & G.		Geography, B.		Reading		Writing			
III., B. & G.		Geography, B.		Reading		Writing			
II., B. & G.		Geography, B.		Reading		Writing			
I., B. & G.		Geography, B.		Reading		Writing			
VI. & VII., D.S.		Arithmetic		English		Writing			Wednesday.
VI. & VII., H.T.		Arithmetic		English		Writing			
V., D.S.		Arithmetic		English		Writing			
V., H.T.		Arithmetic		English		Writing			
IV., B. & G.		Arithmetic		English		Writing			
III., B. & G.		Arithmetic		Science		Writing			
II., B. & G.		Arithmetic		Science		Writing			
I., B. & G.		Arithmetic		Science		Writing			
VI. & VII., D.S.	Marking and Closing Registers.	Arithmetic	Criticism Lessons.	Reading		Writing			Thursday.
VI. & VII., H.T.		Arithmetic		Reading		Writing			
V., D.S.		Arithmetic		Reading		Writing			
V., H.T.		Arithmetic		Reading		Writing			
IV., B. & G.		Arithmetic		Reading		Writing			
III., B. & G.		Arithmetic		Reading		Writing			
II., B. & G.		Arithmetic		Reading		Writing			
I., B. & G.		Arithmetic		Reading		Writing			
VI. & VII., D.S.		Drawing, B.	Needlework (Girls)	Recitation	French to Upper Div.	Singing			Friday.
VI. & VII., H.T.		Drawing, B.		Recitation		Singing			
V., D.S.		Drawing, B.		Recitation		Singing			
V., H.T.		Drawing, B.		Recitation		Singing			
IV., B. & G.		Drawing, B.		Singing		Recitation			
III., B. & G.		Drawing, B.		Singing		Recitation			
II., B. & G.		Drawing, B.		Recitation		Singing			
I., B. & G.		Drawing, B.		Recitation		Singing			

as a hand-maiden to the Staff Notation. His aim is to give to every child a thorough grounding in the Tonic Sol-Fa Notation according to the Code, and, in addition to that, children in Standard IV. and upwards shall be able to sing fairly well at sight a simple tune or anthem from the Staff Notation.

On October 17, Mr. J. Spencer Curwen, of London, visited the school. The upper division were put through various severe tests in the Tonic Sol-Fa Notation. A long test in the Staff Notation was then put on the blackboard. It was in key D, $\frac{3}{4}$ time, and provoked the remark from Mr. Curwen that it contained some 'awkward intervals.' At the second attempt the children sang the test without a mistake, beating their own time. Mr. Curwen briefly addressed the scholars, remarking on the fine tone and the open vowel sounds, and complimenting them on their ability to read from the Staff Notation.

The secret of whatever excellence the school has attained in vocal music lies in devoting at least five minutes each day to its practice.

Another feature of the musical success is the morning entertainments, which are held at various times. After the Scripture lesson a boy or girl steps upon the platform of the head master's desk and sings a song or plays a violin or piano solo. The performance of one item each morning only lasts about a couple of minutes, and the performance is always rewarded with plenty of applause.

Here is the programme for the week in which my visit was paid :—

GREAT HORTON BOARD SCHOOL.

WEEKLY CONCERTS.

Programme.

Week ending Oct. 28th, 1892.

MONDAY.

Recitative . . 'Then shall the eyes' } . *Handel*
Air . . . . 'He shall feed His flock' } (*Messiah*)
TOM SYKES.

TUESDAY.

Song and Chorus . 'Come, birdie, come' . . . ——
EMILY STEAD.

WEDNESDAY.

Ballad . . . . . 'Ettie May' . . . . *Thomas*
GREENWOOD KITCHING.

THURSDAY.

Song and Chorus . 'Shall we ever meet again' . . *Reed*
HERBERT DARLING.

FRIDAY.

Song . . . . 'Ivy, I cling to thee' . . . ——
ETHEL COLLINS.

In his principal assistant, Mr. Newton Laycock, who is a bass vocalist of great ability and considerable request on the concert platform, Mr. Sykes has a most efficient seconder to his efforts in producing good singing.

In this way Mr. Sykes has discovered at various times some lovely voices among the boys and girls. The attempt begets confidence and emulation, and very often parents will come in during a morning to hear their children sing these solos.

Mr. Sykes has championed the cause of poorly-paid assistant teachers with great vigour in the columns of the local press. He has pointed out that the position of the assistant has undergone a radical change during the past ten years or so. It has been a fiction with school boards and managers of schools that the assistant is always a young man merely holding the lower post until a well-merited preferment to a Headship comes to him. The promotion is well merited in thousands of instances, but it is very slow in coming round. Schools are made larger and head teachers are fewer; consequently, there are thousands of fully-qualified assistant teachers that can never hope for advancement. That being so, Mr. Sykes points out that facts should be looked in the face, and the position of assistant in a large school should be made sufficiently attractive in itself to form a career for a young man.

TACT
IN THE BUSINESS OF SCHOOL-KEEPING.

By RICHARD BALCHIN.

SEVENTY-FIVE per cent. of the assistants at present employed in schools will remain assistants to the end of their career. The chance of any one of us obtaining a Headship is as twenty-five to a hundred. I use the word 'us' because I wish to look at the subject now under discussion from an assistant's point of view.

This being the case, we have ample opportunity of closely observing, from our subordinate position, the various types of Heads with whom we come in contact. The characteristics of two such types have already been under review. We now propose to devote our attention to type number three, and to note the special tact which we conceive to be necessary in our dealings with such a one. He is no other than—

THE TREMENDOUS CRAMMER WHO GOES STRAIGHT FOR 100 PER CENT., AND WHO TAKES CARE TO INFORM 'HIS MEN,' AS HE CALLS THEM, THAT THEY ARE 'NO GOOD HERE' UNLESS THEY CAN PASS OVER 95 PER CENT.

Fowls are crammed for the Christmas market. Pellets of food, about an inch long, and as thick as one's little finger, are rammed down the throats of the unhappy creatures. This method of treatment, by daily doses of cylindrical dinner-pills, is deemed necessary in order to prepare the birds for consumption at the Christians' annual festival. Many a poor fowl dies during the process of cramming. And of those that survive, it is found that the result of all this trouble is not the formation of good substantial muscle-flesh, but only of an extraordinary amount of poor adipose tissue—mere flabby fat. It is little short of a miracle that a single bird should escape falling a victim to fatty degeneration of all its organs, so unnatural has been the treatment.

In the Scripture syllabus of the London School Board the teachers are directed to give such explanations as are suited to the capacities of the children. 'Capacities of the children!' Good. Wise and good. What is the meaning of 'capacities of the children?' If those children are in Standard IV. they learn 'measures of capacity.' They learn what a 'peck' is, or a 'gallon,' or a 'bushel,' or, I believe, a 'kilderkin.' I am not sure of the last, but have a notion something was taught me, forty or fifty years

ago, about a kilderkin; if so, the knowledge, remaining unused so long a time, has relapsed to a most rudimentary idea. There is one important fact, however, which a fourth-standard child can easily grasp. You cannot get a bushel of anything into a peck measure; nor a peck into a gallon measure. His tables of 'measures of capacity' make this quite clear to him.

Have we any measure of the capacity of a child's mind? Is there an infant-mind's capacity? A boy-mind's capacity? And a man-mind's capacity? Those people who talk about the capacity of a child have the notion that the human mind is a sort of chamber which will hold so much, and no more. This is not the place to discuss this question. But I am not quite sure that such an idea, and all the other ideas clustering about it, are not vain imaginings.

I prefer to regard the mind of a child as a little cluster of latent powers which it is our business to train, strengthen, and enlarge. The instruments we have at hand for this purpose are certain branches of knowledge. And upon our skill in the use of these instruments depends our success in the whole work. Clearly, there are two directions in which this skill shows itself. First, the entire understanding of the material upon which we work, viz., the 'mind of a child.' Second, the complete adaptibility of the instrument used to secure the end we have in view. Among the many characteristics of the child's mind which we *ought* to be thoroughly acquainted with is its 'grasp'; its ability to receive; its 'receptivity.' This is probably what some people mean who talk about its 'capacity.' Now the mere crammer takes no account whatever of this receptivity. He does not care whether the young mind is really able to stretch out its varied tendrils and grasp the food placed before it, just as the watchful sea-anemone reaches out its myriad arms to seize the nutrient morsel and convey it inwards, there to be digested.

We assistants certainly have the advantage of those teachers who were in training forty or fifty years ago. We have read and studied the modern writers on psychology, and know perfectly well that our great work is based upon that science. We *know* that the crammer is no educator. He is a mountebank and a quack. What shall we do, then, upon finding ourselves a subordinate to such a one? What shall we do when instructed to produce certain results in our class without any thought whatever as to the effect upon sixty impressionable natures which the production of such results undoubtedly entails? Well, I can only say, don't let us prostitute our powers to such ignoble ends. Let us be, first and foremost, educators. Let us await patiently the time when we shall reach a position where scope and freedom will give us the opportunity of working out the ideal which we feel to be the true aim and purpose of our work.

The last type of character in the series to which these articles have drawn attention is—

THE REAL HEAD; HEAD IN INTELLIGENCE, IN TEACHING POWER, IN MANNERS, AND IN CONDUCT; WHO NEVER HAS TO 'TAKE STEPS' TO MAINTAIN HIS POSITION, FOR IT IS FREELY CONCEDED.

Unfortunately there are, at the present time, very few of these. In my rather long experience I have met but one. Bodily, he is now dead; but in thousands of busy minds he is more alive than ever. This was Mr. Shields, the master of the old Birkbeck Schools at Peckham. He was naturally a Head. He was far beyond us all in knowledge. None of us could give a lesson as *he* gave it. In manners, a gentleman; and in conduct, entirely upright, manly, and noble. Of course *he* held his position as Head; and this was simply due to the fact that he *was* Head *de facto* as well as *de jure*. Now, in calling to one's mind the many Head Masters under, say, the London School Board, where shall we find the man who combines within himself these desirable qualities? Most of them are exceedingly good men, with considerable experience in the management of boys. But a short conversation with them upon any subject outside their special sphere of daily work, is sufficient to indicate the narrowness of their intellectual attainments. On this point I am one with Mr. Stanley in the hope that, before long, every Head Master under the Board will be in the possession of his university degree. Of course, the 'degree' is not everything, although it is one of the essential things. If I am to 'look up' to a man, he must be a gentleman in bearing and conduct. He must be one in whose uprightness of character I can repose implicit trust. I cannot possibly 'look up' to one whom I inwardly despise.

Happy the lot of those assistants who recognise in their Head one who is their superior in attainments, in honour, and in all those points which absolutely claim their love and regard.

VITAL STATISTICS.

BY WALKER OVEREND, B.SC. (LOND.), B.A. (OXON).

Late Scholar of Balliol College, and Radcliffe Travelling Fellow; Deputy Lecturer on Physiology at St. George's Hospital, London, W.

51. *Offensive Trades. Trade Nuisances, etc.*—Offensive trades are dealt with in Sections 112–115 of the Public Health Act, 1875, and the same trades are enumerated in the Metropolis Act, 1874, and the Public Health Bill for London, 1891. (See notes on Sanitary Law in the May number.) They are (1) Bone-boiling and crushing, (2) Soap-boiling, (3) Tallow-melting, (4) The trade of a slaughterer, etc. Before a conviction is possible, it is necessary to prove that the best practical means for the abatement of the nuisance have *not* been adopted.

Tallow-melting.—Nuisances arise during the melting of the fat and in the storage of the residue. The vapours should be consumed by applying fire with air to the top of the pan. The refuse must be placed in closed receptacles to prevent the escape of effluvia. The floors, made of concrete, must be kept clean, and must slope towards a gully. Proper drains, trapped and grated, passing to the public sewer must be provided. The ceilings and walls are to be washed with hot lime-wash twice a year.

Bone-boiling.—The operations should be conducted in steam-jacketed pans, rather than with open fires.

In *Soap-boiling* the fats are boiled with soda or potash. The source of nuisance here is again due to the fats. Now acrolein is a product of the decomposition of glycerine, and fats with oils are compounds of glycerine with certain organic acids, so that whenever a fat or oil is heated up to its temperature of decomposition, acrolein is liberated. This is a vapour which is very irritating to the eyes and throat.

Manure Manufacture may consist simply of crushing bones, or, in the manufacture of superphosphate of calcium, by treating bones with sulphuric acid, when vapours arise which must be condensed, or manure may be made from sewage sludge. Every bone boiler, soap boiler, tallow melter, and manure manufacturer must see that the

boilers and other vessels are properly covered, and the vapours first conducted to a condenser, to permit the steam to separate, and then passed through the furnace fire, or at least prevented from escaping into the atmosphere. All refuse material, etc., must be stored in closed rooms, to prevent offensive effluvia entering the air.

52. *Slaughter-houses.*—Private slaughter-houses should be abolished, and replaced by public abbatoirs. Slaughter-houses, in accordance with the provisions of the law, must have proper tanks for the blood, they must be lighted, paved, drained, and provided with an ample water supply. Every part of the floor must be washed three hours, at the latest, after the slaughtering is finished. The inner walls must be covered with hard, smooth, impervious material to the height of six feet from the floor.

53. *Cow-keeping.*—Nuisances may arise from the manure, and from the storing of grain. The floor must be properly paved, the drainage must be perfect, and the water supply plentiful. The principal provisions of the Cowsheds' and Milkshops' Order, London County Council, 1885–86, are (1) Dairymen must be registered. (2) Persons suffering from dangerous infectious disease must not be permitted to milk cows or handle the milk vessels. (3) No cesspool, water-closet, etc., must be within, or communicate directly with, any dairy or milkshop. (4) The milk of diseased cows must not be mixed with the rest of the milk, but may be used as food for pigs, etc., after boiling. (5) Every cowshed must be lighted and ventilated sufficiently, and have 600 cubic feet space for each animal. (6) Every cowshed must be paved with bricks and set with cement on concrete, with a slope towards a gully outside the shed, and the drainage passing to sewer must be adequate. (7) The walls must be whitewashed twice a year, the floor cleansed once a day, and manure must not be stored so as to become a nuisance. Dairies must be sufficiently lighted, thoroughly ventilated, with well-paved floors sloping to an opening in the wall, and leading to a properly-trapped gully. No inlet to a drain must exist within the dairy. There must be an ample supply of good water.

54. *Glue Making.*—Gelatine is obtained by boiling hides, bones, horn, etc. These are first treated with lime, the lime removed by washing in water, then they are boiled, the fat skimmed off, and the glue run into troughs, where it solidifies. The process of boiling is accompanied by offensive odours, to prevent which, after condensation of the steam, they should be burnt up in the furnace fire. Accumulation of the deposit left in the pans after the glue is run off must not be permitted. It has some value as manure. The floors of the establishment must be of concrete, sloping to a gully, and the drainage must be efficient.

India-rubber Making.—Crude india-rubber is boiled, washed, and treated with carbon bi-sulphide (CS_2), which softens it and facilitates the penetration of the sulphur. The nuisances are, the odour of india-rubber, hydrogen sulphide (H_2S), and CS_2. In some of the processes also naphtha is used. To avoid these nuisances the rubber must be boiled in closed vessels, the vapours burnt up in the fire, and the naphtha condensed or passed into a scrubber containing creosote, which absorbs it.

In the *Distillation of Wood* to produce wood naphtha, the wood is heated in retorts, and the vapours coming over are condensed. Nuisance may arise from gases which escape condensation; also, when the retorts are emptied and recharged. The drawing of the retorts must be done quickly, and uncondensed gases must pass to a tall chimney shaft, or be burnt up.

55. *Coal Gas.*—Coal is heated to redness in closed retorts, and the vapours pass over to condensers, where some steam, tar, and ammonia are left. These fall into a space below. The gas is now crude coal gas, and contains marsh gas or methane (CH_4), olefiant gas or ethene (C_2H_4, the illuminating agent), hydrogen, carbon monoxide, nitrogen, H_2S, and some tarry matter. The mixture passes into cylindrical towers called *scrubbers*, and is there made to pass through water, which dissolves the ammonia, then through oblong boxes (purifiers) containing lime, where CO_2 and H_2S are absorbed, then into oxide of iron purifiers to absorb what is left of the H_2S.

There is some unavoidable nuisance in the drawing of the retorts, which is done to remove the coke and recharge with coal. Certain offensive gases and steam are evolved, since the coke is raked out into water. Another nuisance is the spent lime from the purifiers, and the conveyance of this to its destination. The trucks should have special covers.

The ammoniacal liquor should be stored in air-tight tanks. It is mixed with lime and distilled. The ammonia liberated is received into dilute hydrochloric acid (HCl) or dilute sulphuric acid (H_2SO_4), to form chloride and sulphate respectively. The CO_2 and H_2S not absorbed by the acid must be passed through the furnace fire to avoid nuisance. The tar, formerly run off into water courses, is now disposed of to manufacturers of carbolic acid, benzine, and aniline, etc.

The Coal Tar is distilled, and the products are (1) light oils containing benzine, etc.; (2) heavy oils or creosote oils, heavier than water, and containing carbolic acid, etc. The crude material must be carried from the gas-works in air-tight receptacles, and the gases evolved during the distillation passed through water and burnt up in the furnace. The carbolic oil obtained is treated with caustic soda, which is siphoned off, and then with H_2SO_4, the *carbolic acid* is ladled off and redistilled. Nuisances arise from the odour of carbolic acid and escape of gases towards the end of the distillation, and also by removal of the coke which is left behind in the retorts. To avoid the latter, the coke should only be removed when cold.

56. *Alkali Works.*—Salt is decomposed by heating with sulphuric acid, and hydrochloric acid escapes. The sulphate of sodium formed (salt-cake) is mixed with chalk and coal. Sodium carbonate, sulphate of calcium, and carbon are left. This is termed *black ash*. When water is added, the sodium carbonate dissolves and leaves the residue, 'tank waste,' consisting of some carbonate and sulphate of calcium, sulphide of calcium, etc. The acid fumes evolved from alkali works are sulphuric and hydrochloric acid, chlorine, hydrogen, sulphate, etc. The tank waste accumulates, forming large mounds. The calcium sulphide oxidizes slowly, becoming a thiosulphate, and an offensive odour of H_2S is evolved, but more especially if the waste catches fire. Now the sulphur is separated from the waste by processes devised by Mond and Mactear.

The Alkali Acts (1864–1874) provide that 95 per cent. of the hydrochloric acid produced must be condensed. The owner of each alkali works must use the best practicable means of preventing the discharge into the air of the other noxious gases, as the fumes of chlorine, sulphurous, and sulphuric acids.

57.—*Sulphuric Acid* is obtained by roasting sulphur or copper pyrites: the sulphur dioxide (SO_2) evolved is oxidized into sulphuric acid by the oxides of nitrogen set free by the action of sulphuric acid on sodium nitrate. The gases pass into large leaden chambers, into which steam and air are blown, and the weak acid is concentrated in platinum stills or glass retorts. The pyrites is roasted in ovens provided with close-fitting sliding doors, so that it is only when the doors have to be opened that SO_2 escapes. In the transmission of the gases leakage may take place, which must be corrected. Nuisances are avoidable with proper fittings, suitable ovens, and proper condensing arrangements. For details as to process of manufacture, consult a work on chemistry.

In the manufacture of *Salt*, by evaporation of brine, in Cheshire, open pans are heated by flues ending in chimneys 30 feet high. Nuisances arise from the evolution of SO_2, HCl, smoke, and from the accumulation of the waste-heaps.

Chloride of Lime or Bleaching Powder.—In the Deacon process, chlorine is prepared by passing HCl over red-hot bricks saturated with a solution of copper sulphate. The chlorine gas is wasted by passing through water, dried over strong sulphuric acid, and is then passed into lime. Proper precautions must be taken to prevent chlorine gas from leakage, and during the packing of the powder in casks.

In the manufacture of *Oxalic acid from Sawdust* the latter is mixed with potash and evaporated to a paste, which when dry is treated with water and the oxalate allowed to crystallize. Lime is added, and the oxalate of calcium is boiled with H_2SO_4, the oxalic acid being allowed to crystallize. Vapours are evolved during the evaporation of the mixture of sawdust and potash, and during the action of the H_2SO_4 on the oxalate, which should be conveyed to a tall chimney shaft or burnt up in the fire. As a matter of fact, in all chemical works there should be efficient arrangements to remove noxious fumes, to secure ventilation, and disperse irritating vapours, and to lessen the exposure of the workmen to heat.

Tin-plate Manufacture.—Iron plates are placed in boiling sulphuric acid, thence into palm oil, and finally into pots containing melted tin covered with a layer of the same oil. Acid fumes and acrolein are evolved during the process; these should be collected, passed through purifiers, then through the furnace fire.

Manufacture of Coke and Breeze.—Here there is a destructive distillation of carbonaceous material, air being partially excluded, and impure carbon is left. The process is performed in ovens, or in piles, that is, in heaps. In the latter case dense smoke is evolved, since the carbonaceous material is burnt in a hollow perforated dome made of brick, and the mass is lighted in the centre. To avoid the fumes, a flue should be connected with the centre of the dome, and the products drawn off by a fan through underground flues and condensed. In the case of ovens, the vapours pass into a tall chimney, and are liberated at such a height, that little nuisance is produced.

58. *Brick Burning.*—Bricks may be burnt in piles or in kilns. In the former, the clay bricks are mixed with a small proportion of ashes, and arranged in layers alternating with breeze—refuse household ashes. The latter is then set alight by small fires of wood and coal. The process is very offensive. The gases evolved consist of the two oxides of carbon, HCl, H_2S, and steam. It should be prohibited altogether in the neighbourhood of towns.

Where bricks are burnt in kilns, no combustible material is mixed with them. They are burnt by the aid of coal. Careful stoking is necessary, and a long chimney shaft to carry off the smoke.

Manufacture of Cement.—There are two kinds of hydraulic cement (*a*) Roman, made from Septaria clay; (*b*) Portland cement, made from an artificial mixture of clay and limestone. In the latter, the chalk and clay are mixed under water and then run into depositing tanks. A wet mud is the result, which is dried and burnt in kilns. If these are open a nuisance is produced from the evolution of H_2S, CO_2, and, sometimes, of cyanogen compounds. The fumes should be burnt, or discharged from a tall chimney, 150 feet high. The smoke and gases destroy surrounding vegetation.

59. *Tuberculosis* is a general term, which includes those diseases in which the bacillus tuberculosis plays the essential rôle. As a result of the invasion and growth of this microbe, small masses of a greyish or yellowish colour are formed within the organs attacked, which are termed tubercles—hence the name tuberculosis. Tubercle may be developed in any tissue, but the lungs, the peritoneum and intestines, and the coverings of the brain are particularly vulnerable. In the first instance, when the lungs are the seat of disease, *pulmonary phthisis* or *consumption* is the result; in the second, *tabes mesenterica* or abdominal phthisis; in the third, *tubercular meningitis*. About 50,000 die annually from consumption in England and Wales; and 18,000 from the other two. Tubercular meningitis and tabes mesenterica affect children. Of the conditions which induce tuberculosis some affect the general constitution from before birth—heredity. In such children a feeble resistance to the invasion of the bacillus exists; in other words, the bacillus readily finds suitable soil for its growth and development. But a tuberculous parent may actually directly transmit the disease through the milk. In cases of tubercle of the udder in cows, Bang found that the milk contains the specific bacillus. The milk of tuberculous cows with healthy udders sometimes contains tubercle bacilli, and then it is dangerous. However, as a rule, the mucous membrane of the intestines presents an impenetrable barrier, and it is only when the functions of the intestines are depressed or some alteration in the fluids secreted exists, that these bacilli can enter. Once having passed the barrier they pass by the lymphatics to the lymphatic glands of the mesentery, where again they may be arrested and destroyed, or they may begin to grow, according to the vital condition of the glands themselves.

Other circumstances affect the general constitution in the course of life, as (*a*) air rendered impure by deficient ventilation, or by being rebreathed; (*b*) insufficient food and exercise; (*c*) intemperance and late hours; (*d*) exposure to cold and wet; (*e*) dampness of soil. Impure air is an important factor in the production of consumption, since the death rate increases *pari passu* with the density of a population, with the degree of over-crowding and deficiency of ventilation. Also in proportion as people are attracted to indoor occupations.

Other conditions affect the lungs themselves, as the constant inhalation of dust. (*Vide Infrà*).

Prevention.—(*a*) Proper ventilation must be secured and overcrowding remedied; (*b*) sufficient exercise in the open air should be taken; (*c*) damp soils should be efficiently drained; (*d*) tuberculous meat and milk avoided. Consumptive patients should really be treated as if suffering from a communicable disease. The breath is not dangerous; but the sputum should be prevented from drying, by being received into rags, which are burnt at once; or the sputum may be received into vessels containing 10 per cent. carbolic acid. Otherwise, the sputum dries, is disseminated through the air of the room, and becomes a source of danger.

60. *Dust Diseases.*—These diseases occur in workmen who constantly breathe a dusty atmosphere. There are several obstacles, however, which prevent dust from reaching the delicate air-cells. The hair of the nasal cavities and of the moustache intercept some, while the mucous membrane lining the trachea or windpipe and the bronchial tubes is provided with cells possessing hair-like processes or cilia, which are continually in movement, and carry particles upwards towards the external air. (See Elements of Physiology by the author, para. 42 and 92.) If the quantity of dust is great, and the inhalation continuous, these agents become powerless, and dust then reaches the air-cells in greater or less abundance. Passing through them, the particles enter the delicate lung-tissue itself. Here they set up irritation, which excites the formation of connective tissue (fibrosis, or cirrhosis). Such lungs, after death, are found to contain hard lumps of connective tissue, in the centres of which the irritating solid particles may be found. As a result of the presence of these hard masses the inflating power of the lungs becomes diminished, a chronic bronchitis is set up, the tissue of the lungs becomes enfeebled, and its resistance lessened. It now forms a suitable soil for the reception and development of the tubercle-bacillus.

The first feeling of such workmen is one of irritation in the throat and air-passages, leading to a cough. Then a feeling of oppression over the sternum is experienced, with much shortness of breath, followed, after a time, by the expectoration of a dirty-coloured sputum. They suffer, in short, from symptoms resembling chronic bronchitis with asthma. A true pulmonary consumption may follow, although this result is somewhat unusual. Such dust-disease is produced by mineral substances, as particles of coal dust, or by particles of steel and grit (metallic dust) in the grinding of steel goods, by pearl dust in the manufacture of buttons, and by organic dust in the case of the fluff, etc., of cotton and flax mills.

Chest diseases predominate among *coal miners*. The particles of coal are less irritating than those of metallic dust, since they are more rounded, but they finally induce the above symptoms of cough, shortness of breath, and expectoration of a dark sputum. This chronic bronchitis rarely proceeds to genuine tuberculosis, since the coal-dust particles are believed to exert a protective influence against the bacillus. The ill-health of coal miners is not solely due to this dust, however, since the mines are often badly drained and therefore damp, the temperature is high, and the miners often work in awkward and constrained positions.

Among *potters* the flat-pressers, who form the flat articles to be produced, as plates, saucers, etc., upon a Plaster-of-Paris mould, and the china scourers, who beat off the dust from the ware, suffer most. They become asthmatical and suffer from chronic bronchitis. It is the siliceous particles of the clay which renders the process detrimental to health. They are not so harmful as metallic dust, but they are more irritating than coal dust.

Stonemasons suffer largely from chest troubles. The quality of the stone influences its action. Soft stones appear to do more harm than the very hard ones, as granite. It has been pointed out that the dust of granite consists of much coarser particles, too large probably to reach the air-cells. Stonemasons exhibit a high death rate from chest diseases, in some instances the chronic bronchitis passing into a true pulmonary phthisis.

In the Sheffield Trades the grinders suffer severely from pulmonary disease, especially when no water is used on the grindstone (dry grinding). It would be much better if wet grinding could be used entirely, and dry grinding dispensed with altogether; but it appears that certain small articles, as forks, scissors, needles, require the harder and coarser friction of dry stones. The heavier articles, as saws, scythes, and the like, are ground wet. The average duration of life in dry grinders is not more than 33 years.

Flour Mills contain a certain amount of dust, and after some years millers suffer from cough and shortness of breath. In the old mills the siliceous dust from the wear of millstone was injurious. These are now replaced by steel rollers. Among millers pneumonia is the most frequent disease. Their mean duration of life is about 45 years.

Cotton weavers suffer from the fine dust produced during the earlier processes. The atmosphere, moreover, is vitiated by overcrowding and by the burning of gas. Weaving sheds also are hot, and the air is full of moisture. Where there is heavy sizing the dust of China clay is an additional injurious agent. The temperature and humidity of the sheds are now regulated by the Cotton Factories Act, 1889.

Workers in *Woollen* factories suffer less from chest complaints, but the wool-sorters may contract anthrax from certain wools. This, which has been termed wool-sorter's disease, is highly dangerous. All wools should be slightly moistened before sorting.

In *Flax* and *Shoddy* factories a very irritating dust is set free. The operatives suffer from chronic bronchitis, and occasionally spit blood.

The dust of *iron compounds*, as that of the two oxides, is used in the arts for colouring paper, etc. Bronchitis is set up, with the expectoration of a reddish sputum, which contains iron.

61. In the manufacture of *glass* silica is mixed with various bases, as soda (in the form of sulphate and chloride), potash, lime, lead oxide, etc. The mixture is fused by means of coal fires, or by means of gas, mixed with air. The latter is preferable, as very little smoke is then evolved. The noxious fumes are those of HCl, H_2SO_4. Workers in glass factories suffer from the excessive heat, from the smoke and dust, and from the effects of blowing. They are subject to diseases of the chest, since the latter becomes somewhat round and barrel-shaped (emphysema), from bronchitis, heart disease, dropsy, and rheumatism. The cutting and engraving of glass is done by small fine-edged wheels, which rotate rapidly. Their action is aided by emery and putty powder. Since the latter contains lead, the artisans occasionally suffer from plumbism. Chest diseases are also prevalent among glass cutters. Few live beyond 50.

62. *Ventilation.*—Mines are usually ventilated by lighting a fire at the bottom of one shaft. The air is drawn down the other, and traverses the galleries. From one to two thousand cubic feet per

head per hour may be thus supplied in the best ventilated mines. Other methods of ventilating factories, underground passages, etc., are (1) the Blackman Air Propeller, in which a fan is driven at the rate of 300 revolutions per minute, and discharges 15,000 cubic feet during the same interval of time; (2) the Eolus Water Spray Ventilator, in which a fly-wheel provided with fans is set in motion by a jet of water being directed against them. It may be used either to propel air into a mine, or to exhaust it, and the amount may obviously be regulated by the force of the water. (3) In some cases steam jets have been employed, which passing up the shaft or chimney set in motion masses of air 200 times the bulk of the jets.

Exhaust fans are the best for withdrawing dust from factories, and should always be used where steam power is available for driving them. In smaller factories, where steam power is absent, gas engines may be used to propel the fans.

For more detailed information as to Trade Nuisances and Diseases, the valuable report of Dr. Ballard, in the Supplement to the Local Government Board, 1876, and Dr. Arlidge's work on the Diseases of Occupation may be consulted.

63. *Lead Poisoning*, or plumbism, may be contracted in various ways, *e.g.* (1) By exposure to the vapours of the fused metal. (2) By contact with lead, as in persons whose employment is the rolling of sheet lead, or the making of lead pipes, or the covering of articles with lead foil. (3) By the ingestion of lead compounds with the drinking water, one-tenth of a grain per gallon, in the course of time, will induce it. (4) Lead has been also used in the manufacture of cosmetics and violet powder, in adulterating snuff, and has been found in the white lining of silk hats. (5) Plumbers are sometimes affected by the fumes of solder which contains lead. (6) The yellow chromates also are used to colour artificial flowers, soap, sealing wax, and in dyeing.

White Lead, or lead carbonate, when ground into paste with oil, is the basis of our common paints. The lead is first melted, ladled out, arranged in plates, and placed in earthenware jars, into which some acetic acid is poured. The jars are packed in tan, and then placed in large chambers with free access of air. The CO_2 produced by the fermenting tan decomposes the acetate of lead slowly, producing the carbonate. After some weeks the jars are removed from the chambers, carried out, and the white lead is crushed and dried. The possibility of lead poisoning is obvious. Many processes have been suggested to supersede the above, and render the manufacture less harmful, as the McIvor ammonia process, and Professor Gardner's electrolytic method, in which the lead is attacked by nascent CO_2. Unfortunately the white lead obtained by these methods is far inferior and coarser in quality.

The Symptoms of lead poisoning, briefly, are: (1) Severe pain in the abdomen (lead colic); (2) paralysis of the back of the fore-arm, or wrist-drop; (3) a blue line upon the gums; (4) dyspepsia; (5) emaciation and anæmia; (6) disease of the kidneys; (7) convulsions and blindness. Women seem more particularly liable to the last symptom.

By the Lead Factory Regulations (1) scrupulous cleanliness must be enforced. (2) Food must *not* be eaten in workrooms where lead is used. (3) Ventilation must be efficient. In some factories lavatories and baths are provided for the artisans, acidulated drinks, as lemonade containing sulphuric acid, also capacious blouses or overalls to cover the whole body, and respirators. Since women are particularly susceptible to the more dangerous symptoms of plumbism, and will neither wear the overalls nor the respirators, it would be well to prohibit their employment in lead factories.

Action of Water on Lead.—In towns the service-pipes leading from the water-mains into the houses are of lead, and some waters even in this short distance may take up so much lead as to be dangerous. The water first drawn in the morning, after it has been standing during the night, is especially to be avoided. When distilled water is placed in contact with lead, the oxygen, or the nitrate in solution, acts upon it, forming a hydrate which is more or less soluble. The waters which have most action on lead are the purest, and such as contain nitrates, nitrites, chlorides, and waters containing organic animal matter. Waters containing chalk, phosphates, etc., have a protective influence. The real reason why water takes up lead is still a matter of controversy. Some lay the blame on the absence of silica, while others think the waters of moorland reservoirs, where lead poisoning has at times prevailed in the towns supplied, acquires an acid property, from certain vegetable acids passing into solution.

The *precautions* to be taken may be thus enumerated: (1) The addition of lime to the reservoirs—the water passing in should run over beds of lime; (2) the running to waste of water which has stood in the pipes overnight; (3) the use of lead pipes with an internal coating of tin, or pipes previously coated with a film of carbonate by being kept for some time in strong solution of sodium carbonate, etc. The precautions necessary in white lead factories have been already mentioned.

Arsenic.—Arsenious acid manufacture is carried on in Cornwall. The ore, or sulphide, is first crushed, then calcined, and the acid is deposited in the flues. Calciners suffer from skin diseases and from ulcers; also from bronchitis due to the fumes of SO_2. The brilliancy of the arsenitis of copper—Scheele's green and Schweinfurth's green—has led to their use in colouring wall papers, artificial flowers, fruits, in decorating children's toys, and in dyeing. Also arsenical salts are used in making fly paper, and it is said they are used for colouring some soaps. In some artificial flowers 10 grains have been obtained from 50 leaves, and 20 yards of a green tarlatan ball-dress yielded 100 grains. The disadvantage is that the arsenic is not fixed, but becomes diffused into the atmosphere, and may be inhaled or swallowed. The consequences are chronic inflammation of the stomach, inflammation of the eyes and skin, debility and wasting. The tinting and staining of paper used for wrapping fancy goods and wall paper soon affects the artisans, who cannot continue the work for long.

Phosphorus.—The wooden stems are dipped in sulphur or paraffin, then in phosphorus paste, consisting of a mixture of phosphorus, potassium chlorate, and glue. The phosphorus emits fumes, and these are dangerous. With amorphous or red phosphorus there are no fumes, but the paste made with the latter is less readily inflammable than that containing ordinary or white phosphorus. The dangerous compound appears to be the sesquioxide present in the fumes.

Match makers suffer from inflammation, ending in destruction of the bone of the lower jaw. This lasts for about two years, until the artisan dies from debility. Some individuals escape. The poison is said by some to enter through bad teeth, and children with such are prohibited from employment in match factories. Scrupulous cleanliness must be enforced throughout, and open vessels containing turpentine should be suspended within workrooms.

Brass Founding.—The mixers suffer severely. The copper is first melted, and the zinc then mixed with it. When the metals come in contact, some of the zinc is thrown off in the form of dense white clouds. The workmen cover their mouths with cloths to avoid breathing it. The group of symptoms from which the workmen suffer is termed 'brass founder's ague.' A so-called fit commences with depression and weakness, followed by cold sweats, chills, headache, and vomiting. There is thus a superficial resemblance to true ague. The symptoms have been attributed to the fumes of oxide of zinc, but copper vapour no doubt also plays a part. Brass founders are also said to suffer from gout, weakness of the legs, and debility. Inhalation of brass dust induces the same symptoms as other metallic dusts do—cough, shortness of breath, and bronchitis.

Mercury vapour affects philosophical instrument makers. Its effects on the system are shown by excessive secretion of saliva, ulceration of the gums, loosening of the teeth, depression, and vomiting. In chronic poisoning, as seen in those who silvered mirrors, etc., pallor, derangement of the stomach, tenderness of the gums, and a trembling of the limbs were the chief symptoms.

64. *Diseased Meat, etc.*—Medical officers of health and inspectors of nuisances may inspect any animal, carcase, meat, poultry, flesh, vegetables, bread, etc.

Cases occur when, after eating some article of food, illness, vomiting, and intestinal irritation have followed, sometimes leading to a fatal termination. Pork is accredited with most of the cases, but sausages, brawn, meat pies, and tinned meats have also at times produced similar symptoms. In some of the instances the poison has seemed to be of the nature of certain substances, termed *ptomaines*, produced during the decomposition of the meat, and not destroyed by cooking. There was a pork pie and brawn poisoning case at Retford in 1887, where the meat pies contained microbes. In the Arlford sausage poisoning case the meat had come from America. Mice and rabbits died when fed with it.

Wholesome fresh meat is acid in reaction. It has no disagreeable smell, and its colour is normal. Meat which is sodden contains much water, and is usually diseased.

Measles in the Pig and Ox.—In this disease small cysts are found scattered throughout the flesh, especially in the muscles of the neck, tongue, and shoulder. They perish at 170° F.; also brine will destroy them after an immersion of some days. If the meat be improperly cooked and eaten, the cysts become tapeworms; it should therefore be condemned.

Trichinosis sometimes affects pigs from eating offal and other garbage. This is due to a small worm, the *Trichina spiralis*, which lies in a cyst coiled up in spiral fashion. Man becomes trichinous when such pork or bacon is eaten.

In *Foot and Mouth* disease the milk of the diseased cows will produce the same disease in man. In this malady there are blisters on the tongue, udder, and between the toes. The flesh is said to be wholesome (?).

Cattle plague is contagious. The flesh is soft, dark, and unfit for food.

65. *Tuberculous Meat.*—Much discussion has raged around this subject of late years. In the first place, the possibility of transmitting the disease to man must be admitted. If only the pleura and lungs are affected, the rest of the viscera healthy, and the flesh shows no bacilli, but is healthy and wholesome looking, it seems a great hardship to condemn the whole carcase, for tuberculosis is a disease which may remain localised for a long time; and to condemn all such meat, would render the price almost prohibitive to the working classes. If the disease appears widely diffused, and the lymphatic glands in many parts are tuberculous, the whole should be unhesitatingly condemned; for if eaten in a half-cooked state by children who inherit a feeble tissue-resistance, it would infallibly produce the disease. On the other hand, to condemn carcases which show the merest local sign of tuberculosis, would simplify the duty of an inspector. Otherwise inspectors, varying in leniency of judgment, might occasionally pass meat which should be condemned. Moreover, the question of compensation and its difficulties arises.

Anthrax kills a number of oxen and sheep yearly in England. The disease is due to the bacillus anthracis. The flesh is dark red, or black and friable, and should be condemned.

Questions set by the Science and Art Department.

(16) Describe the manufacture of coal gas. What nuisances are liable to be produced in the neighbourhood of gas works? (1887.)

(17) Describe the processes adopted by an artificial manure maker or a soap boiler. State the nuisances liable to be produced in either case, and the precautions you would adopt. (1888.)

(18) What are the processes employed at 'alkali works'? What nuisances may be caused by them, and how may they be prevented? (1889.)

(19) What are the characters of the waters that have a solvent action on lead pipes and lead cisterns? What measures are necessary to prevent or counteract such action? (1891.)

(20) Describe the process of brick burning or the manufacture of alkali, and the nuisances that may result from either, with precautions to be adopted. (1891.)

(21) What trade manufacturing processes are likely to give rise to disease of the lungs? Explain their deleterious action, and state the means of precaution to be adopted. (1892.)

(22) What are (*a*) nuisances; (*b*) offensive trades, under the Public Health (London) Act, 1891? (1892.)

NEW DICTATION TESTS.—STANDARD IV.

Suitable for 'Unseen Tests' in Reading also.

No. 264.

Everybody knows what miracles of success were once achieved by the Jesuits in the education of youth. What was the secret of the astonishing influence they exercised over the world but the sagacity they showed in placing each of their pupils in the sphere for which nature had specially organised him? Who can doubt that such a system of education, if adopted among us, would add immensely to the moral power of the State?

No. 265.

Some of the natives in Central Africa are dwarfs; otherwise they are not more deformed or uglier than many savage tribes of full-sized folk. They waddle so much when they walk that they cannot carry a full dish without spilling some of its contents! They are cunning and of low intelligence, but are excellent hunters, for which reason they are protected by the people among whom they have settled, who employ them for the purpose of procuring food-supplies.

No. 266.

The patron saint of Wales is said to have been the son of a Welsh prince. He was an archbishop, and, according to an old historian, he was 'a mirror and pattern to all, instructing both by word and example, excellent in his preaching, but still more so in his works. He was a doctrine to all, a guide to the religious, a life to the poor, a support to orphans, a protection to widows, a father to the fatherless, a rule to monks, and a model to teachers; becoming all to all, that so he might gain all to God.'

No. 267.

Imitation diamonds are so well got up now that it is frequently difficult to tell a genuine one without applying a test. You will notice that a diamond has a small flat surface on its face: this is called the table. If a merchant has any doubt about the genuineness of the stone, he takes a fine file and applies it to this table, when, if the stone is real, you may rub away for hours without leaving even the faintest scratch. Should the stone be an imitation, the file will soon leave a decided mark, which tells at once that the stone is worthless.

No. 268.

The biggest ruby in the world is found in the Czar of Russia's crown, which has the distinction of being the finest ever worn by any sovereign. In shape it resembles a bishop's mitre, and on its crest is a cross composed of five superb diamonds, which support the 'biggest' ruby. An arch, composed of eleven magnificent diamonds, supports this cross, and on each side of the arch is a hoop of thirty-eight pearls, than which there is none handsomer in the world.

No. 269.

Some ants make their dwellings in the soil, in the turf, and even in the clay. Often an ants' dwelling-place may be found under a stone, which serves for its roof. In making their dwellings they have been likened to miners, architects, and carpenters, for they show much skill in making tunnels and rooms underground, in planning their dwellings, and in lining their nurseries with bits of wood. The ants' dwelling-places are conical mounds.

No. 270.

On the tables of the squires and nobles was sometimes seen, at Christmas and other festive seasons, a peacock pie; but so costly was the dish that it was only the very wealthy who could face such extravagance. At one end of the pie the peacock's head, in all its plumage, and with beak richly gilt, appeared above the crust, while at the other end the tail, with feathers outspread, made a brave show. The dish, however, was regarded more in the light of a superb ornament to the table, for it was not very good eating.

No. 271.

You will sometimes read in the newspapers of quarrels between the drivers of competing omnibuses; and one of the plans used to force a rival off the road is known as 'nursing.' An omnibus is started just in front, another just behind, the rival 'bus; but, as a rule, the front one is not employed. The object of following up so closely is to pick up its passengers, and thus starve it off the road by preventing it from getting enough custom to pay the proprietor. These efforts occasionally bring both men to the Police Court. This kind of competition is regarded by the public with great disfavour as mean and unfair.

No. 272.

Money has been found in all sorts of queer places, and some of the finds have been very valuable from an antiquarian point of view. The thigh-bone of a horse is rather a strange place in which to deposit money; but, on one occasion, a man removing rubbish discovered such a bone, and accidentally found that it had a silver lining. On examination, the cavity disclosed upwards of 100 Roman silver coins.

No. 273.

The majority of men who have succeeded in life have been unable to point to unusual opportunities. They have made the best of the passing time and prevalent surroundings. To the one man who finds the large, weighty nugget of gold, at which the world wonders, there are hundreds who sift the precious metal out of the sand in tiny particles. But they who thus obtain it by care and perseverance may accumulate as much wealth as the more fortunate seekers.

No. 274.

The Queen is by no means fond of jewellery. She simply wears two enamel bracelets, each containing a portrait. The one worn on

the right arm contains the portrait of the Prince Consort, and on the left that of Her Majesty's youngest great-grandchild. The Queen says: 'On the right wrist I carry my first and greatest love, and on the left, the last bud that it has pleased God to allow me to look upon.'

No. 275.

The ability to talk well is either a great gift or an accomplishment painfully acquired. It is by no means to be despised, but, on the contrary, to be admired and honoured. But it requires a long course of preparation; for no person, no matter how great a gift of natural eloquence he may have, can continue to speak much, and maintain a reputation for ability, unless he makes sure what he is talking about.

No. 276.

Tapestry weavers are placed, as it were, behind their work, so that they look on the wrong side of it. To their eyes there is nothing but a meaningless tangle and jumble of meeting and crossing threads. But to him who looks from the other side, the whole beautiful design is apparent. Every thread has a meaning and a mission—is effective not only as a separate thread, but in connection with every other thread. Nothing is purposeless, nothing could be spared; nothing is in excess. The whole elaborate pattern is a masterpiece of exquisite combination, and the gazer is lost in wonder and admiration at the skill of the designer.

No. 277.

Good taste is a true economist. It may be practicable on small means, and sweeten the lot of labour as well as of ease. It is all the more enjoyed indeed when associated with industry and the performance of duty. Even the lot of poverty is elevated by taste. It exhibits itself in the economies of the household; it gives brightness and grace to the humblest dwelling; it produces refinement, it engenders good will, and creates an atmosphere of cheerfulness.

No. 278.

Frederick the Great desired to take a mill down in order that he might enlarge the gardens round his palace, which on one side were rather cramped. But the miller refused to allow the building to be removed. Being asked whether the King might not take it by force, he stoutly replied that in that case he should appeal to the Parliament. The King admired the miller's spirit, and pursued the matter no further. The mill was very small then, but was rebuilt on a larger scale at a later date. During the next reign, the miller being pressed for money, offered it to the King, but he declined to take advantage of the man's difficulties, and generously helped him to get over his troubles without losing his property.

No. 279.

It seems that the Swiss are in the ascendant at the present time as waiters. They will work hard, are thrifty and enterprising, and do not mind what they do, even to including the work of a charwoman among their other duties. The hours of a Swiss waiter are long, but they put up with this, as very fair incomes are made by them.

No. 280.

The village street runs down the steep hillside,
Between the quaint old houses to the sea;
At times the road is buried in the tide,
Just where it joins the tempest-beaten quay.
The church stands high; a landmark far around,
It proudly rears its tower against the sky;
And on the hillside is the burying-ground,
Where generations of rough sea-folk lie.

(H.M.I.'s TEST.)

STANDARDS V.—VII.

No. 244.

The supply of servants seems to become yearly more scanty. English householders experience increasing difficulty in obtaining cooks, housemaids, and nurses who possess the training requisite to make them useful in domestic service. There are many who attribute the falling off to the increase of education among the servant class, which makes them rise superior to a mode of life that their mothers considered respectable enough. But it must be remembered that during the last forty years, at least, America has been draining Great Britain of her servants.

No. 245.

Now that America seems to be fairly well supplied with servants, Australia has begun to draw upon us, and great numbers are monthly being despatched to the antipodes, where they find the high wages and much of the independence that America offered them long ago. So great is the demand in New South Wales that even the large furniture shops are constantly applied to by those to whom they have despatched orders to know if they can send out servants who understand how to take care of the costly furniture received from England. It is small wonder that our own supply is falling short.

No. 246.

Thanks to Lord Tennyson, the 'Charge of the Six Hundred' is almost the only one of these episodes which occupies a large place in the popular imagination; and the survivors of the Light Brigade, who cannot be called a retiring body of heroes, have not been backward in profiting by the circumstance; nor have they failed to assert, with considerable emphasis, their claims to recognition and reward—claims which have not been entirely ignored by the public. It may occur to some of us that quite sufficient attention has been paid to the survivors of the gallant Light Brigade, whose bravery was probably equalled by that of the Heavy Brigade, and whose sufferings were certainly exceeded by those of the Infantry of the Guards and the Line, who went through that awful winter in the trenches before Sebastopol.

No. 247.

If any prejudiced person is inclined to dispute the claim of Cardinal Manning to be regarded as an eminent Christian, he has only to be referred to his will. Excluding his books, which to such a man were a necessity, he died possessed of less than a hundred pounds. Of course, we must not forget that the Cardinal had no family ties, and was in a position which made him absolutely certain that his few temporal wants would be provided in his lifetime; but how few there are, even under such favourable circumstances, who so fully obey the injunction, 'Lay not up for yourselves treasures on earth.' The will and the funeral of the Cardinal ought to be sufficient to show the bishops and archbishops of the Established Church that it does not need from five to fifteen thousand a year to enable religion to exalt her mitred front among princes.—(H.M.I.'s TEST.)

No. 248.

The Volunteer corps, among the other advantages attending it, has had this great and conspicuous merit, that it has brought the great and intelligent masses, the strength and backbone of the country—into direct, useful, and most healthful relation with the question of public and national defence. If one thing more than another is the business of the nation, it is that it should be defended by the nation, and not by a class picked up here and there, through the artifices of recruiting officers; but that the defensive forces of the nation should represent the pith, the strength, and the moral as well as the physical force of the body of the nation itself.

No. 249.

One of the wonders revealed by the microscope is that human hairs possess a marked individuality. Not long ago, a single hair—the evidence in a murder case—was shown a celebrated doctor with the request that he would determine whether it was from the head of the supposed murderer, whose hair was of the same colour. After examination, the specialist decided that it was sufficiently unlike that of the suspected man to acquit him. The real murderer was subsequently captured, and his hairs were found to be identical in character with the one first examined.

No. 250.

Argand, the inventor of the lamp which bears his name, had been experimenting for some time in trying to increase the light given out by his lamp, but all to no purpose. On a table before him one night lay an oil flask, the bottom of which had been accidentally broken off, leaving a long-necked funnel-shaped tube. This he took up carelessly and placed, almost without thought, as he afterwards related, over the flame. A brilliant white light was the magical result, and the hint was not lost by the experimenter, who proceeded to put his discovery into practical operation by 'inventing' the glass lamp chimney.

No. 251.

We advise every person either buying or renting a house, whether in town or country, and whether for a short or a long period, to require a certificate from a sanitary engineer, and not to be satisfied, as at present is too often the case, with the mere assurance of the agent. He is an interested party, and is either only superficially acquainted with the sanitary condition of the house or else totally ignorant of it. The demand for sanitary engineers of high character and attainments would soon create the supply of trustworthy and competent men. The poor may rely upon the local inspectors to protect their lives; but for the well-to-do to omit to protect themselves is an act of folly which surely only needs to be made apparent to cease to be committed.

No. 252.

Noises in the head proceed from so many and various causes that it is often difficult for a medical man to determine the cause. It is a very distressing complaint, affecting persons in weak health in various degrees. It is a marked symptom of mental fatigue and anxiety. It is also caused by defects in the circulation, an undue flow of blood to the head, and is apt to be produced by whatever increases the action of the heart, such as late hours, strong drink, violent muscular or mental exertion, and whatever may agitate the mind; strong tea or coffee will also intensify the complaint.

No. 253.

Regarding the employment of soldiers in the postal service, the Duke of Cambridge has issued a supplementary memorandum, in which he urges upon the officers through whom applications may be made the necessity of the utmost care being taken that only such men be recommended as from their antecedents are likely to fill the posts with credit to the army and themselves, and to the entire satisfaction of the Post Office. His Royal Highness considers that no man should be recommended who has been twice intoxicated during the last six years, or once within three years of his application, and especially no man who, while with the colours or in the Reserve, is known to have been guilty of misappropriating money.

No. 254.

An automatic hen has just entered the field of industry. An inventor has constructed a machine which, if it does all he claims for it, will give the hens a long-needed rest, and perhaps force them entirely out of business. The automatic hen is formed of springs, cog-wheels, and other self-acting machinery. The inventor asserts that a dozen of them are capable of laying 100,000 eggs a day; and they are such close imitations of the ordinary hen-fruit that it is difficult to distinguish them from the old-fashioned eggs.

No. 255.

An alarming accident occurred recently. A large hall, intended to accommodate about 700 persons, has been in course of erection. It was complete, excepting the roof; but the walls suddenly collapsed and a number of workmen were precipitated to the ground. Nine of them were buried in the *débris*. Help was instantly rendered by a number of volunteers, and in the course of twenty minutes the poor fellows were dug out and conveyed to the hospital, where seven doctors were promptly in attendance. It is feared that at least two of the cases will prove fatal. The collapse is attributed to the subsidence of the foundations, caused by the heavy rains.—(H.M.I.'s TEST.)

No. 256.

A French gentleman whose works on the various diseases of the eye are highly esteemed has closely examined the effect of captivity on the sight of wild beasts, such as lions and tigers, and asserts that all animals in a savage state are far-sighted. The same remark applies to man in an uncivilized state, and even to those who, though civilized, follow avocations which oblige them to remain constantly in the open air, such as sailors or farm labourers. The same faculty exists in caged animals when they have been taken after the age of six or eight months; but when born in captivity, or kept in cages when very young, they become near-sighted, which the Frenchman attributes to the narrow space in which they are confined, and the training which obliges them to follow the eye of the keeper or tamer to obey his will.

No. 257.

It is quite possible to walk through the main sewers of London, and the walk can extend over a great number of miles. The sewers of the Metropolis are as carefully mapped out as the streets themselves, and the authorities can find their way about in them quite easily. Curiously enough there is little that is unpleasant in a descent to underground London. The passages are egg-shaped, and built of glazed white brick, and quite clean. The swarms of rats are diminishing. The old sewers, built of soft brickwork, were terribly ineffectual. To-day our sewer-men are a healthy-looking body, and rarely suffer from the effects of their strange journeys.

No. 258.

Would'st thou fashion for thyself a seemly life?
Then fret not over what is past and gone;
And, spite of all thou may'st have lost behind,
Yet act as if thy life had ne'er begun;
What each day wills, enough for thee to know,
What each day wills, the day itself will tell:
Do thine own task, and be therewith content;
What others do, that shalt thou fairly judge;
Be sure that thou no brother-mortals hate,
Then all beside leave to the Master Power.

No. 259.

For some time past a little town in the north of France has been the scene, at frequent intervals, of serious fires. That they were the work of an incendiary was suspected, but the culprit escaped detection owing to the fact that no motive could be assigned for his crimes. The secret is out at last. It seems that in many small towns in France the drink shops are allowed to remain open all night whenever an alarm of fire occurs, the idea being that the firemen and others who help to put it out need refreshment. This being so, a fireman deliberately set fire to houses in order that he might have the privilege of carousing in prohibited hours.

No. 260.

A heart that ever overflows
With love for all its kind,
And, pitying weak humanity,
To errors oft is blind.
A hand that in the cause of right
Is lifted not for greed,
These two with a clear head combined,
Make just the man we need.

A maiden such as makes a home
Seem brighter every day,
With willing steps and soft sweet mien,
Whose words like music play.
Whose mind o'er dress and fashion soars,
And worth 'neath labour sees.
Looking for good in everything—
We need such girls as these.

NEW COMPOSITION STORIES.—STANDARD V.

Suitable for 'Unseen Tests' in Reading also.

24.

A Heroic Negro.—One day a terrible storm arose on board a man-of-war, the captain of which was at the time on shore—having left on board two little boys, the one four and the other five years old, under the charge of an old negro servant. The crew and all on board the ill-fated ship struggled to get away from her into a large boat before she was wrecked; and we are told the negro took the two little children, tied them in a bag, flung them over his shoulder, and afterwards placed them into the boat, which was quite full. The negro was on the point of stepping into the boat himself, but the officer in charge cried out that there was no room, and that either he or the children must perish, for the weight of both would sink the boat. Without a moment's hesitation the noble African's mind was made up, 'Very well,' said he, 'take the children to my master and tell him I ask his pardon for all my faults;' and thereupon he plunged into the waters, and was never seen again.

25.

Pat and the Hare.—A gentleman while out shooting one day had the good fortune to catch a hare, which he had come upon as it lay asleep. Thinking the animal might amuse some ladies of his acquaintance, he despatched his Irish servant with it safely tied down inside a basket and duly labelled. The curiosity of Pat, however, overcame his discretion on the way. He undid the string that held down the lid, when out popped pussy, and away she flew like lightning, across the fields. 'Be jabers,' exclaimed Pat, as he scratched his head and looked after the retreating animal, 'you may run, but, faith, you don't know where to go; for you've forgotten to take the address with ye!'

26.

A LESSON IN POLITENESS.—A friend of Dean Swift one day sent him a turbot as a present by a servant who had been on similar errands, but had never received anything for his trouble. Having gained admission, he opened the study door, and putting the fish on the floor, cried out rudely: 'Master's sent you a turbot.' 'Young man,' said the dean, rising from his easy chair, 'is this the way you deliver a message? Let me teach you better manners. Sit down in my chair; we will change places, and I will teach you how to behave in the future.' The boy sat down, and the dean going out, came up to the door, and making a low bow, said: 'Sir, master presents his kind compliments, hopes you are well, and requests your acceptance of a small present.' 'Does he?' replied the boy. 'Return him my best thanks, and here's half-a-crown for yourself.' The dean, thus caught in his own trap, laughed heartily, and gave the boy a crown for his ready wit. The teacher, as well as the scholar, received a lesson that time.

27.

A MODERN MIRACLE.—There once lived a French parish priest who was greatly beloved. His parishioners decided upon presenting him with a cask of wine. One of the inhabitants supplied the cask, and each of the rest were to pour in two quarts of the produce of his vineyard. A short time afterwards the priest invited the subscribers to dinner, in order to taste the beverage which formed a compound of all the wines grown in the district. The servant went to turn the tap, and came back with a decanter full of water in her hand. 'Whatever is that?' was the general cry. 'This is the wine out of the barrel.' His Reverence could not make it out; it was altogether puzzling! The guests were splitting with laughter. Each one had thought to himself that the presence of two quarts of water would not be detected in a cask of wine, but, as it happened, they had all acted on the same idea.

28.

A WISE MAGISTRATE.—A magistrate in China had brought before him a man charged with stealing a table. The man denied the charge, alleging that he was so feeble from ill-health that it was physically impossible for him to commit such a crime. The magistrate listened gravely to the tale, and professed his sympathy and sorrow for the poor man. 'Go home,' he said, 'and get cured, and as you are very poor, take that bag, which contains 10,000 coins, as a present from me.' The prisoner made obeisance, threw the heavy bag over his shoulder, and departed. He had not gone far before he was arrested, and brought back, and found guilty; the magistrate remarking that a man who could carry off a heavy sack could have had no difficulty in stealing a table.

29.

A SAD AWAKENING.—An hotel keeper noticing that some of his customers were evidently trying to eat their suppers in the shortest possible time, lest they should miss the boat which was waiting at the wharf, thought it would be very funny to frighten them. Accordingly he went into a back room and gave a remarkably perfect imitation of the steamboat's whistle. The joke worked well. The men heard the sound, and rushed to the boat, and the joker laughed loud and long, until suddenly it occurred to him that the men had gone off without paying for their suppers. Then he stopped laughing.

30.

THE FAITHFUL NEGRESS.—Some years ago an earthquake did much damage in one of the West Indian Islands. From one house all the inhabitants had escaped excepting an old negro servant and her master's infant child. The house shook to its foundation, and the negress ran upstairs to the chamber in which the child was sleeping. The moment she entered the room the walls of the house fell in. Anxious only for the safety of her sleeping charge, she threw herself over the infant, and thus protected it from the falling stones and timber. When search was afterwards made, the child was found perfectly safe, but the faithful servant was so badly injured that she died shortly afterwards.

31.

A 'CUTE OLD WOMAN.—An old woman in Orkney was noted for selling whisky without having a license. Her house was a few miles from a town, and the excise officers had tried in vain to get her convicted. So many attempts had failed that they had given up the task as impossible. A young officer was appointed to the place, who said, on being told about her, that he would soon secure her conviction. Early one morning he left the town, and arrived at the old woman's house by seven o'clock. Walking in he saw no one, but noticing a bell on the table he rang it. The old woman appeared. He asked for a glass of milk, which was set before him. After a little he rang again, and the old woman appeared. He asked if she had any whisky. 'Ay, sir,' said she, 'we have some in the bottle,' setting it down before him. He thanked her and laid down a sovereign, which she took and walked out. After helping himself he rang again, and asked for his change. 'Change, sir,' said the old woman, 'there's no change. We have no license. What we give we give in presents; what we get we take in presents. So good day, sir.' The exciseman left the house poorer and wiser.

32.

THE HORSE AND THE STAG.—A horse had the whole range of a meadow to himself; but a stag came and damaged the pasture and the horse was eager for revenge. Accordingly, he went to a man, and begged him to help him punish the stag. 'Willingly,' said the man, 'only let me put a bit in your mouth and get upon your back, and I will find the weapons.' The horse agreed, the man mounted, and together they hunted down and killed the stag. But from that time the horse has always been the slave of man.

33.

THE BELLS OF LIMERICK.—One of the most beautiful and touching legends is that of the 'Bells of Limerick.' They were made by a young Italian, after years of toil, and purchased by the Superior of a convent near one of the Italian lakes. The artist invested his fortune in a pretty villa on the shores of the lake, expecting to pass his life where daily he could hear the music of his bells wafted across the waters. But by a misfortune he lost all, and found himself penniless and homeless. The convent was afterwards destroyed, and his beloved bells were carried to a foreign land. He became a wanderer, and grew old before he found a resting-place. But all these weary years the memory of his bells had never left him. One day he met a mariner who told him of a wondrous chime of bells he had heard in Ireland. Something told the artist that the bells were his. After long journeyings, sick and weary, he came to port near Limerick and took passage in a small boat for the city. Before him the tall steeple of the church lifted its head above the smoke of the old town. He leaned back wearily, yet with happy expectation, for something was whispering that his bells were there. Suddenly from the church towers pealed the wondrous music of the bells. The boatman paused to listen, while the old Italian fixed his streaming eyes upon the tower. The old familiar sound of his bells brought back again his youth, and sweet memories of home and early friends. And he was happy at last—too happy to speak. When the oarsman sought to arouse him, his face was still upturned, but his eyes were closed. He had breathed his last.

34.

GIVING HIM A LESSON.—The Sultan of Morocco, not long ago, discovered that one of his viziers was becoming too powerful. He therefore summoned him to tea, and complimented him on his great wealth. The vizier, becoming vain, boasted of the number of his houses, horses, wives, and slaves, and the sultan rebuked him, saying that he was too rich, and thought too much of himself. To show the man exactly what he was worth, his majesty had him taken up by soldiers to the slave-market, where he was put up for sale, and received only one bid of eightpence. He was taken back to the sultan, who said to him, 'Now you know your proper value, eightpence. Go home and ponder on it.' When the man reached home, however, he found that nearly all his property had been taken away by order of the sultan. Only one small residence, one wife, one horse, and one slave had been left him.

35.

PUT IT LOWER.—It is told by one who has spent much time in Sweden that, in the course of a revival meeting, there came to the church a young man, in appearance unkempt, ragged in clothing, and bare of foot. He placed himself in front of the pulpit. The preacher was most earnest in his sermon. The face of the young man was constantly turned up towards him. At the close of the service, the deacons passed the plates for the offerings. The young man seemed so poor that no one ventured to offer him the plate. As the deacon passed near to him, with impetuosity the poor youth ejaculated, 'Put it lower.' The deacon hardly understood the remark at once. The young man repeated, 'Put the plate lower.' The deacon held the plate near his hand. 'Lower yet,' he said. 'Still lower.' 'Lower down yet,' he cried. The deacon at last put the plate upon the floor. Then the young man quietly, but earnestly, placed himself upon his bare feet in the plate. He had no money to give, but he gave himself.

36.

A TRUE STORY.—In a remote village in the West of Scotland, a little boy was playing alone. All at once a cry arose from children

playing near that some young horses had broken loose and were galloping down towards them. In a moment the road was clear save one dark speck at the other end. It was the little child. So intent was he upon his game that he never heard them coming. On came the horses. Nothing could be done to save the child. At some little distance from it was an old horse quietly feeding. Attracted by the noise, he looked up and saw how matters stood. In a moment he sprang forward, seized the child in its mouth, and carrying him some distance laid him gently on the grass just as the other horses passed by.

37.

WHY CATS WASH AFTER EATING.—This is the reason, according to an old fable, why cats wash their faces after meals: A cat caught a sparrow and was about to devour it, but the sparrow said, 'No gentleman eats till he has first washed his face.' The cat, struck with this remark, set the sparrow down, and began to wash his face with his paw; but the sparrow flew away. This vexed pussy exceedingly, and he said, 'As long as I live I will eat first, and wash my face afterwards.' Which all cats do to this day.

38.

WELL PUNISHED!—The Emperor of Russia, when upon a tour of inspection, passed a night in the simple hut of a toll-taker. Before retiring, he was pleased to see the old man take up his Bible and read a chapter. 'Dost thou read often?' he asked. 'Yes, your Majesty—every day.' 'How much of the Bible hast thou read?' 'During the past year the Old Testament and part of Matthew, your Majesty.' Thinking to reward him, the Czar on the following morning placed five hundred roubles between the leaves of the book of Mark without the knowledge of the toll-keeper, to whom he bade farewell. Several months passed away, and the Emperor returned, upon a second tour, to the toll-keeper's hut. Taking the Bible in his hands, he was surprised to find the five hundred roubles intact. Again interrogating the toll-keeper as to whether he was diligent in reading, he received an affirmative answer, the man stating that he had finished the chapters of Luke. 'Lying, my son, is a great sin,' replied his Majesty. 'Give me the Bible.' Opening the book, he pointed to the money, which the man had not seen. 'Thou hast not sought the kingdom of God. As punishment thou shalt also lose thy earthly reward'; and the Emperor placed the roubles in his pocket, to distribute afterwards among the neighbouring poor.

39.

THE WAY THE NATIVES CATCH TIGERS.—One of the methods of tiger-hunting practised in India is very curious. The natives scatter on the ground over which the tiger is likely to walk a large number of broad palm leaves, thickly daubed over with a sticky substance, almost like glue. Then they retire to a safe distance, or perch in high trees to await the enemy. When he comes he plants his paw on one of the leaves. It sticks fast. He shakes it, then tries to wipe it off on the ground; but still it sticks. He then like a cat tries to get rid of it by rubbing it against his face, and only succeeds in rubbing the stuff into his face and eyes. Getting angry, he roars loudly, and rolls about on the ground, thus covering himself all over. He is now in a terrible rage, and is quite blinded with the daubed leaves. So the natives come from their hiding places, and quickly put him out of his misery with their spears and arrows.

40.

CAUGHT IN THE SLING.—Some time since, while a swallow was flying about a house, it caught its foot in a sling that was hanging from a pipe in the roof. Of course the bird got frightened at becoming an unwilling prisoner. It struggled and fluttered to no purpose, and when the poor thing was thoroughly tired, it simply hung helpless by its leg. Meanwhile its sad case had roused the pity of its swallow mates, which all flocked round it from every quarter. After a good deal of talk among themselves, it seemed as if they had at last decided upon a plan; for presently one bird after another struck at the sling with its back, and after half-an-hour's steady work they succeeded in cutting the cord and in setting the captive free.

41.

UNEXPECTED RESULTS.—A certain gentleman attended chapel one Sunday morning, as was his custom, and at the end of the service was preparing to go home when he suddenly discovered that his umbrella had been taken. On the following Sunday morning he attended the chapel as usual, and at the close of the service was allowed by the minister to address the congregation. He told them his umbrella had been stolen on the previous Sunday morning and that he knew the thief. Being of a retiring disposition, however, he would say nothing about the matter if the person who took the umbrella would drop it over his garden wall the same evening. He then awaited results. Next morning he was astonished at finding fifteen umbrellas in his garden. Evidently there had been more than one thief on that particular Sunday morning.

42.

STORY OF A BOY'S AFFECTION.—As an instance of the affection existing between a boy and his parent, the following story is told. During the French Revolution, a lady and her daughter, together with her son, a lad of 15, were confined in prison, and ultimately brought to trial. The mother and daughter were condemned to death, but little notice was taken of the son, except that he was sent back to prison. 'What,' said he 'am I thus to be separated from my mother? It must not be,' and he instantly shouted, 'Long live the King.' He was then immediately sentenced to death, and was led out to execution with his mother and sister.

43.

INSCRIPTION OVER A GATEWAY.—Over the triple doorway of the Cathedral of Milan there are three inscriptions spanning the splendid arches. Over one is carved a beautiful wreath of roses, and underneath is the legend: 'All that which pleases is only for a moment.' Over the other is sculptured a cross, and there are the words: 'All that which troubles is but for a moment.' Underneath the great central entrance in the main aisle is the inscription: 'That only is important which is eternal.'

44.

ST. SWITHIN'S DAY.—The explanation of the old saying about St. Swithin's Day is as follows:—St. Swithin, Bishop of Winchester, was a man equally noted for his uprightness and humility. So far did he carry the latter quality that on his death-bed he requested to be buried, not within the church, but outside in the churchyard, on the north of the sacred building, where his corpse might receive the eaves-droppings from the roof, and his grave be trodden by the feet of the passers-by. His lowly request was complied with, and in this neglected spot his remains reposed till about a hundred years afterwards, when a fit of indignation seized the clergy at the body of so pious a member of their order being allowed to occupy such a position; and on an appointed day (July 15) they all assembled to convey it with great pomp into the adjoining cathedral of Winchester. When they were about to commence the ceremony, a heavy rain burst forth, and continued without intermission for the forty succeeding days.

NEW READING TESTS.—STANDARD III.

Suitable for 'Unseen Tests' in Dictation also.

50.—'You have some fine ducks this morning,' said a kindly old schoolmaster to a poulterer. 'Yes, sir, all fresh to-day.' 'What is the price?' 'You can take your choice, sir. I have them at all prices.' 'Well, I want to give my boys a treat, but I do not want them to be too tender. There are a dozen here—pick out four of the toughest.' The poulterer obeyed. 'Here, sir, you have four of the toughest birds in my shop.' 'Thank you,' said the schoolmaster; 'I'll take the other eight.'

51.—On certain evenings in the summer-time the children from the courts and alleys of London are allowed to run about the grass lawns of the Temple Gardens! Poor little mites, it is the nearest approach to the real country that many of them know, and they thoroughly enjoy themselves as they tumble about, forgetting for an hour or two their wretched homes.

52.—There is a certain excitement about acting nobly; we know that people will hear of us, and we know that we shall see the result of our work. A beloved father saved from death, a darling sister snatched from the fire, even a stranger dragged from the river—these are deeds which bring their own reward with them; it is grand to save a life.

53.—An old lady, who is noted for her charity and good acts, opened the door to a very tattered tramp the other day. He asked for something to eat. While he was eating, the good lady noticed how ragged he was, and her heart was moved. She said: 'My poor man, can't I do some mending for you?' The tramp looked at her a moment, then, pulling a button out of his vest-pocket, simply said: 'Yes, ma'am; I'd like to have you sew a shirt on to that.'

54.—Dishonest people sometimes cheat the railway company by travelling in first class carriages when they have third class tickets. Of course, when there are rushes it is often impossible to get into the right class of carriage, but when there is plenty of room, people will deliberately walk into a first class carriage, though they have only paid third class fare.

55.—The pit opened into the air, but the opening was hidden by the trees, and ferns, and other plants. On the margin of the lake lay a shiny-looking beach or strand; beyond it, under the rocks on the right, ran a kind of causeway raised above the level of the lake. This would serve as a footpath round the water, if the travellers could only reach it.—(H.M.I.'s TEST.)

56.— He doeth well who doeth good
To those of his own brotherhood;
He doeth better who doth bless
The stranger in his wretchedness;
Yet best, oh! best of all doth he
Who helps a fallen enemy.

OUR PUPIL TEACHERS' COURSE.

In our last article we were, perforce, compelled to say 'good-bye' to our Third Years, whose examinations, having been held on the 15th ultimo, have promoted them to the dignity of '*Scholarship Candidates*.'

N.B.—'*Candidate for Queen's Scholarship*' hath a fuller and more mellifluous sound than '*Fourth Year Pupil Teacher*.'

To these we wish all success; and also we heartily welcome the new-comers, the Candidates and First Years, who are only now commencing their pedagogic journey, with the enthusiasm of youth, and the energy of hope not yet deferred.

'First Years' are subject to great temptations, which will require all the force of will, fortified by right principle, to withstand.

The attainments required from them are in many respects less than those demanded from Seventh, and even Sixth, Standard children; and the enticements 'to take it easy' are, therefore, exceedingly strong.

But woe to those who fall thereby. The more arduous tasks of the Third Year and the fatal *competitive* examination of the Fourth are at the door, and the weak of will and infirm of purpose will have their life's intentions frustrated just at a time when they are almost too old to commence a new career.

The lot of the '*plucked*' at the Queen's Scholarship is often very sad. Be ye, therefore, wise to-day; 'tis madness to defer; seize the flitting moments, and render each tributary. Not spasmodic efforts, not untiring industry at the last, not remorseful regret for wasted opportunities, will avail to secure 'College Training,' but persistent, persevering, indefatigable, well-directed, and well-apportioned effort, will succeed.

And there is comfort in this consideration—'Sufficient unto the day is the work thereof'; only it must first rightly be understood what is the day's work. This will, of course, vary with individuals and circumstances, but it may be laid down that 'A good day's work is the full amount of successful labour which can be performed without infringing upon the morrow's capabilities.' About three hours has been found to be the average full time utilisable. There will thus be surplus time for bodily exercise, interesting literature, social enjoyment, rest, meals, leisure, and sleep.

However, every hour should be well-disposed of, not according to the freak of the moment, but in subordination to some well pre-arranged system. It will then be found amazing 'what can be got out of a day.' Are there not in it 24 hours? Look at the following scheme:—

Sleep	9 hrs.
School, and journeying to and fro	6½ ,,
Study	3 ,,
Meals and Rest	2 ,,
Exercise and Society	2 ,,
Reading or Music	1½ ,,
Total	24 hrs.

Our routines will, therefore, assume three hours' study per diem, with the exception of Saturday, when we shall claim four hours; but there will be work set for only 24 days per *Calendar* Month, and an occasional week's holiday will be provided for.

Returning to a previous consideration, we say that Pupil Teachers in their early years must go ahead with the later years' work. By the conclusion of the Third Year every Pupil Teacher should have gained Certificates for Freehand, Model and Perspective Drawing, for Geometry, Advanced Physiography (or some other mark-carrying science) and for (Boys) Second Grade Mathematics. Instead of this last Girls should study Elementary Algebra and Domestic Economy. Moreover, there should be a fair proficiency in Music (vocal and instrumental), and in Latin or French.

Does this seem 'a large order'? We trow that it can be, and often has been, not only fully accomplished, but exceeded by the average P.T. This course would leave the Fourth Year free for special or technical 'coaching' on Scholarship lines.

TEXT-BOOKS.

The following Books are strongly recommended as being up to date, 'in the groove,' and yet sufficiently comprehensive:—

Miscellaneous.—Heller's Code, Stormonth's Dictionary, Dunstan's 'Teacher's Manual of Music,' Hughes's 'Pupil Teacher's Copy Book,' Hughes's 'Art of Handwriting,' Halford-Hawkins' 'Art of Reading and Recitation,'

School-Management.—Gladman's 'School Method.'

Geography.—Gregory's 'Physical and Astronomical Geography,' Gregory's Physiography, Brooks' Geography, W. and A. K. Johnston's 'Multum in Parvo' Atlas, Hughes's 'How to draw a Map,' and Blanchard's 'Geographical Notabilia,' Parts I. and II.

History.—Boyd-Carpenter and Green's 'British History,' Boyd-Carpenter and Green's 'Main Facts and Dates of British History,' W. and A. K. Johnston's 'Historical Atlas.'

English.—Dr. Beach's 'Elements of English,' Dawson's 'Paraphrasing,' Nelson's 'Lives of English Authors.'

Arithmetic.—Wollman's 'Teachers' Arithmetic,' Dixon and Beach's Arithmetic, Wollman's Metric System.

Mensuration.—Todhunter's.

Domestic Economy.—Hughes's Domestic Economy, Mrs. Beach's Domestic Economy, Parts I., II., III..

Euclid.—Deighton's; Egan's Exercises, Part I.

The above works are undoubtedly the cheapest and best. They may be readily obtained from any scholastic stationer.

For RECITATION we advise—

First Year—Longfellow's 'Lighthouse,' 56 lines.
Second Year—Shelley's 'Cloud,' 84 lines.
Third Year—Cowper's 'On Receipt of my Mother's Picture,' 121 lines.
Fourth Year—*See* Scholarship Article.

It will be observed that in no case do we give the bare minimum of lines, nor in any instance seriously exceed it. Many a Pupil-Teacher loses caste in the Examiner's eyes, by mutilating some artistic production, because to present it in its complete beauty would involve the committal of a few more lines to memory. Such conduct is indolence and Vandalism combined.

DON'T use 'Poetry Cards.' Of all the Philistine productions, these are perhaps the worst. Upon them is often present a great display of ignorance, whilst poetic appreciation is glaringly absent.

Learn your recitation at the beginning of the year at the rate of about a dozen lines per week. Master its rhythm and feel its flow. Enter into the poet's mind, and understand the sentiments of which the words are but the outward and visible signs. View it as a work of art, lovely in conception and perfect in execution. Then dissect

Supplement to the May, 1893, Number of the 'Practical Teacher.'

MODEL ANSWERS TO THE PUPIL TEACHERS' EXAMINATION PAPERS.

SCOTLAND, 25th March 1893.

FIRST YEAR.

First Paper.

(Two hours and a half allowed for this Paper.)

DICTATION.

Write from dictation, in a neat hand, with correct spelling and punctuation, the passage read by the Inspector.

[*Every Inspector selects his own Dictation Test.*]

PENMANSHIP.

Write in large hand as a specimen of copy-setting the word 'Rhythmically.'

Write in small hand as a specimen of copy-setting, the words, 'No profit grows where is no pleasure ta'en.'

ARITHMETIC.

Males.

1. In what time will £97 double itself at 5 per cent. simple interest?

£97 : £100 } :: 1 yr. : 20 yrs. Ans.
£5 : £97 }

2. Find the true discount on £76 1s. due nine months hence at 7½ per cent. per annum.

(*a*) Interest on £100 for 9 mos. at 5 per cent. = £5¾.
Amount on £100 for 9 mos. at 5 per cent. = £105¾.

(*b*) ∴ £105¾ : £5¾ :: £76 1s. : Discount.

$$\frac{£76\ 1s. \times 45 \times 8}{8 \times 845} = £4\ 1s.$$ Ans.

3. A bookseller by selling a book for 10s. 4d. gains 24 per cent.; what must he sell it for if he is to gain 10 per cent.?

124 : 110 :: 10s. 4d. : selling price.

$$\frac{10s.\ 4d. \times 110}{124} = 9s.\ 2d.$$

4. At what price must the 3½ per cents. be in order that they may give the same income as an investment in the 3 per cents. at 72?

3 : 3½ :: 72 : Price

$$\frac{72 \times 3½}{3} = 84.$$ Ans.

Females.

1. Find the value of—

·1875 of 6 fur. 4 po. 2 yds. — 3⅜ of $\frac{3}{80}$ mile — $1\frac{5}{12}$ of ·75 pole.

		yards.
·1875 of 6 fur. 4 po. 2 yds.	=	252
— 3⅜ of $\frac{3}{80}$ mile	=	— 220
		32
— $1\frac{5}{12}$ of ·75 pole	=	— 6
		26 Ans.

2. If it cost £6 16s. 1½d. to cover a room with a carpet ⅞ of a yard wide at 2s. 9d. per yard, how much may be saved by using carpet 1¼ yard wide at 3s. 4d. per yard?

⅞ = 1⅜ yd. : ⅞ yd. } :: £6 16s. 1½d. : x
33d. : 40d. }

$$\frac{£6\ 16s.\ 1½d. \times 7 \times 40}{10 \times 33} = £5\ 15s.\ 6d.$$

∴ £6 16s. 1½d. — £5 15s. 6d. = £1 0s. 7½d. Ans.

3. How often can ·053 be subtracted from 14·758, and what is the remainder? (This is division of decimals.)

$$\frac{14·758}{·053} = 275\frac{3}{53}$$

∴ ·053 can be subtracted 275 times, and leave a remainder 3, which from the sum given must = ·003, or $\frac{3}{1000}$.

4. A farmer expected to sell his heifers for £28 each. One-half of them were sold at £27 11s. each, and the other half at £30 5s. each, and thus £36 was obtained more than was expected. How many heifers were there?

First half cost	£27 11s.	each.
Second half cost	£30 5s.	,,
Average price =	£28 18s.	
Expect ,, =	£28	
Gain on each	18s.	

1 heifer gains 18s., how many will it require to gain £36?

∴ £36 ÷ 18s. = 40. No. of heifers. Ans.

GRAMMAR.

1. Give a *general* analysis of the following passage, shewing clearly the relation of the clauses to one another:—

'*Even there*
The listless wave, *that* stole with mellow voice
Where reeds grew *rank* on the rushy-fringed brink,
And the green sedge *bent* to the wandering wind,
Sang with a cheerful song of sweet tranquillity:
Men felt the heavenly influence—and it stole
Like balm into their hearts, *till all* was *peace*.'

2. Parse *fully* the words in italics in the above passage:—

General Analysis.

(*a*) 'Even there the listless wave sang . . . . tranquillity' (*principal sentence*).

(*b*) 'That stole . . . . voice' (*subord. adj. sent. qual. 'wave'*).

(*c*) 'Where reeds . . . . brink' (*subord. adv. mod. 'stole'*).

(*d*) 'Where the green . . . . wind' (*same as 'c'*).

(*e*) 'Men felt . . . . influence' (*prin. sent.*).

(*f*) 'It stole . . . . hearts' (*prin. sent. co-ord. with 'd'*).

(*g*) 'Till all was peace' (*subord. adv. sent. to 'stole'*).

Parsing.

Even—adv. of deg. intensifying adv. 'there.'

There—adv. of place mod. 'sang.'

That—simple rel., anteced. 'wave,' 3rd pers. sing., neut., nom., subj. of 'stole.'

Where—subord. conj. introd. subord. sent. of place, and mod. 'grew.'

Rank—adv. of manner, mod. 'grew.'

Bent—wk. intrans. verb, indic., past, 3rd pers. sing., agree. with subj. 'sedge.'

Sang—strong. intrans. verb, *sing, sang, sung*, indic., past, 3rd pers. sing., agree. with subj. 'wave.'

Like—adv. of man. mod. 'stole.' Note, some consider 'like' a prepos., but in this case 'balm' is gov. by ('to').

Balm—abs. noun., neu., sing., obj. by ('to'), or 'like' if it is considered a prepos.

Till—sub. adv. conj. introd. subord. adv. sent.

All—indef. pro., neu., sing., nom. to 'was.'

Peace—abs. noun., neu., sing., nom. after 'was.'

3. Write down:—

(*a*) The *possessive* singular and plural of—I, which, enemy, dwarf, hero.

(*b*) The *feminine* of—stag, governor, sire, tutor, marquis, abbot.

(*a*) Possessive sing. of	*I*	is	*Mine*	—Plur.,	*Ours.*
,,	,,	*Which*	,,	*Whose*	,,	*Whose.*
,,	,,	*Enemy*	,,	*Enemy's*	,,	*Enemies'.*
,,	,,	*Dwarf*	,,	*Dwarf's*	,,	*Dwarfs'.*
,,	,,	*Hero*	,,	*Hero's*	,,	*Heroes'.*
(*b*) The Feminine of	*Stag*	is	*Hind.*		
,,	,,	*Governor*	,,	*Governess.*		
,,	,,	*Sire*	,,	*Madam.*		
,,	,,	*Tutor*	,,	*Governess.*		
,,	,,	*Marquis*	,,	*Marchioness.*		
,,	,,	*Abbot*	,,	*Abbess.*		

SECOND PAPER.

(Three hours allowed for this Paper.)

GEOGRAPHY.

1. Draw a map of the east and south coasts of *Ireland*, marking and naming the chief seaports, rivers, openings, and capes. (See any good atlas.)

2. Give the exact position of, and any information about, *Bath, Bathurst, Derby, Norwich, Ottawa, Swansea, Sydney, Halifax.*

Bath (named from its baths).—A city in W. of England, co. Somerset. Noted for its mineral waters.

Bathurst, in New South Wales, Australia; a seaport town at mouth of Gambia R., Africa; a town of Dominion of Canada, prov. New Brunswick.

Derby.—A manufacturing town of England, capital of Derbyshire. First silk mill in England erected here.

Norwich.—County town of Norfolk, England; fine cathedral. Seat of manufactures originated by Flemish refugees.

Ottawa, prov. Ontario, Canada.—Seat of government of the Dominion of Canada.

Swansea.—A seaport town of Glamorganshire, S. Wales, on a fine bay of Bristol Channel; resorted to for sea-bathing, and has a large trade in copper, iron, and coals.

Sydney.—The capital of colony of New South Wales, Australia, situated on one of the finest harbours in the world. Great emporium of Polynesian trade.

Halifax.—A town in W. Riding of Yorkshire, England, noted for its woollen manufactures. One of same name in Nova Scotia; has an extensive trade; chief Naval station of British America.

3. What are the chief industries of *Bradford, Merthyr Tydvil, Middlesborough, Coventry, Kidderminster, Macclesfield?*

Bradford.—Seat of stuff and woollen yarn manufactures.

Merthyr Tydvil.—Extensive ironworks.

Middlesborough.—Centre of iron district.

Coventry.—Manufactures watches and ribbons.

Kidderminster.—Iron-foundries, wire-works, tanneries, breweries, dye-works, manufactures carpets.

Macclesfield.—Silk manufacture.

HISTORY.

(Answer any two of the following questions.)

1. Describe the struggle between John and the Barons, and show how its progress was affected by the relations between John and the French king.

While still at war with France John became involved in a contest at home. A quarrel with the Pope led to John's excommunication, and Philip was called upon to invade England. The ill success of an expedition against France forced John to yield to the Pope. Philip, disappointed at this turn of affairs, would still have persisted in his project of invasion had he not been defeated in a naval battle. Notwithstanding this success, the depressed state of John's affairs presented to his barons an opportunity for renewing those demands which they had repeatedly made in vain. The result was the famous meeting at Runnymede in June, 1215, and the concession and signature of Magna Charta.

2. Describe the conquest of Ireland. What claim had Henry II. to lordship over it?

On account of a feud between two rival chiefs war followed, and one Dermot being driven from the island sought assistance from the English king, Henry II. He got the assistance of a small English army commanded by Fitzgerald and Strongbow, who were so successful that no efforts of the Irish could drive the invaders out of the island. Henry, by their invitation, crossed over to Waterford and received the homage of all the chieftains except those of Ulster. In 1174 Henry took possession of the island with the formal sanction of the Pope, and made the native kings and chiefs his tributaries.

3. For what reasons and on what charges were (*a*) Edward II. and (*b*) Richard II. dethroned?

The reasons for the deposition of Edward II. were his silly favouritism, first, for Gaveston, and then for the De Spencers; for his failure in the war against Scotland; and for his utter inability to conduct the government.

The marriage of Richard II. to Isabella, daughter of Charles VI. of France, is believed to have caused the domestic revolution that followed. Richard took vengeance on those who opposed his marriage, Gloucester, among others, being put to death. Hereford and Norfolk having a quarrel were banished, but Hereford having returned was joined by such numbers that he was able to take Richard II. prisoner at Flint. Shortly after he publicly renounced the throne.

COMPOSITION.

Write a short essay on 'A Newspaper,' *or* on 'The Chief Industry of your Neighbourhood.'

A NEWSPAPER.

A newspaper is one of the most wonderful products of the printing-press, and has reached such a state of excellence that it is impossible to do the subject anything like justice within the limits of an examination essay. The few sentences strung together here may, however, indicate summarily the main features of our daily and evening papers. From the column of Births, Deaths, and Marriages, or rather from the title on the top of the first page down to the name of the publisher at the bottom of the last column, the whole of a well conducted paper is replete with every variety of news, suited to the taste of either grave or gay. Leading articles on Politics, Free trade, Education, Ireland, etc., show off the strength or weakness of party, mould public opinion, or guide the uninitiated into the mysteries of statecraft. News is flashed to its pages from every quarter of the globe, and we may have the events of distant countries discussed at breakfast, though these events occurred but twenty hours before.

NEEDLEWORK.

Insert a gusset as for the side opening of a man's shirt. Cast fifteen stitches. Knit eighteen rows, as for the back of a stocking, showing three intakes or decreasings.

LATIN.

1. Decline in singular *nullus dies*, and give the genitive singular of *domus, arbor, quies, cor, caput.*

Nom.	Nullus dies.	Gen.	Nullius diei.
Dat.	Nulli diei.	Acc.	Nullum diem.
Voc.	Nulle dies.	Abl.	Nullo diê.

The genitive singular of *domus* is *domûs* or *domi*; of *arbor, arboris*; of *quies, quietis*; of *cor, cordis*; of *caput, capitis.*

2. Compare *sapiens, similis, prosper, benevolus.*

Pos.	Compar.	Super.
sapiens	sapientior	sapientissimus.
similis	similior	simillimus.
prosper	prosperior	prosperrimus.
benevolus	benevolentior	benevolentissimus.

3. Give the principal parts of *affero, peto, figo, fallo.*

Pres.	Perf.	Supine.	Infinitive.
affero	attuli	allatum	afferre.
pet	petivi	petitum	petere.
figo	fixi	fixum	figere.
fallo	fefelli	falsum	fallere.

4. Parse and give the meaning of *audiaris, amati erant, monendum est, noli, velit.*

Audiaris—2nd pers., sing., pres., subj., pass.; meaning 'thou mayest be heard.'

Amati erant—3rd pers., plu., pluperf., indic., pass.; meaning 'they (mas.) had been heard.'

Monendum est—This is an idiomatic tense formed with the gerundive, equal to the pres., infin., pass. after 'est,' and means 'it is to be advised,' or, 'it must be advised.'

Noli—2nd pers., sing., pres., imper., from nolo, nolui, nolle; meaning 'don't,' or, 'be unwilling.'

Velit—3rd pers., sing., pres., subj., from volo, volui, velle; meaning, 'he, or she, may wish,' or, 'let him wish.'

5. Translate into English and parse the words in *italics*—

(*a*) Pontem *faciendum* curat atque ita *traducit* exercitum.

(*b*) Hac oratione *habita*, omnes, qui aderant, auxilium a Cæsare petere cœperunt.

TRANSLATION.

(*a*) He sees that a bridge is constructed, and so leads the army across.

(*b*.) His speech being delivered, all who were present began to seek help from Cæsar.

PARSING.

Faciendum—gerundive of *fio, factus, fieri*, irreg. 'to be made,' used as the pass. of *facio, feci, factum, facere.*

Traducit—3rd pers., sing., perf., indic., act., 3rd conj., from *traduco, traduxi, traductum, traducere* (trans. duco), 'to lead across.'

Habita—abl., sing., fem., part., pass., 2nd conj., from *habeo, habui, habitum, habere*, 'to have or hold.'

Coeperunt—3rd pers., plur., pret., indic., from the preteritive verb, *coepi, coepisse*, 'to begin or to have begun.'

6. *Translate into Latin*—

(*a*) The Germans were ordered by Cæsar to cross the Rhine.

(*b*) On the third day Cæsar set out with all his forces.

TRANSLATION.

(*a*) Germani Rhenum transire a Cæsare jussi sunt.

(*b*) Tertio die omnibus cum copiis Cæsar profectus est.

SECOND YEAR.

FIRST PAPER.

(*Two hours allowed for this Paper.*)

DICTATION AND PENMANSHIP.

(*See First Year.*)

ARITHMETIC.

MALES.

(*Solve any three of the following Questions.*)

1. Find the difference between the simple and compound interest on £525 in two years at 5 per cent. per annum.

Compound Interest at 5 % = $\frac{1}{20}$ of principal added per annum.

	£	s.	d.	
	525	0	0	
$\frac{1}{20}$	26	5	0	
	551	5	0	amount at end of 1st year.
$\frac{1}{20}$	27	11	3	
	578	16	3	amount at end of 2nd year.
	525	0	0	
	53	16	3	Comp. Int.
Simp. I. =	52	10	0	
	£1	6	3	= diff. between Simple and Comp. Interest.

2. When the 3½ per cents. are at 92, what sum must I invest to obtain an income of £700?

£ £ £

3½ : 700 :: 92 : x.

$$\frac{£92 \times 700}{3\frac{1}{2}} = £18,400 \text{ Ans.}$$

3. If 13 per cent. be lost by selling goods at 14s. 6d., how much ought the price to be raised so as to gain 25 per cent.

87 : 125 :: 14s. 6d. : price required.

$$\frac{14s.\ 6d. \times 125}{87} = £1\ 0s.\ 10d. \text{ Ans.}$$

∴ Price must be raised 6s. 4d.

4. Divide £472 10s. among A, B, C, and D, so that A may have as much as C and D together, B as much as A and C together, and D twice as much as C.

If C gets 1
D ,, 2
A ,, 3
B ,, 4

Total 10 shares.

		£	s.	
∴ A gets	$\frac{3}{10}$ of £472 10s. or	141	15.	Ans.
B ,,	$\frac{4}{10}$,, ,, ,,	189	0.	Ans.
C ,,	$\frac{1}{10}$,, ,, ,,	47	5.	Ans.
D ,,	$\frac{2}{10}$,, ,, ,,	94	10.	Ans.

FEMALES.

1. If 3 men or 5 boys can be kept 4 months for £25, what sum will keep 5 men and 12 boys for 3 months, when the price of provisions is ⅓ more now than it was?

3 men = 5 boys,
1 ,, = 1⅔ ,,
5 ,, = 8⅓ ,,
∴ 5 men and 12 boys = 20⅓ boys.
and ⅓ more = 1⅔ or $\frac{5}{3}$.

5 boys : 20⅓ boys
4 mos. : 3 mos.
5 parts : 6 parts
:: £25 : x.

$$\frac{£25 \times 20\frac{1}{3} \times 3 \times 6}{5 \times 4 \times 5} = £91\ 10s. \text{ Ans.}$$

2. Find the greatest number that will divide 268, 431, and 720, leaving remainders 4, 2, and 5 respectively.

That is, find the G.C.M. of 268—4, 431—2, and 720—5, or 264, 429, and 715.

G.C.M. of first 2 = 33,
G.C.M. of 33 and 715 = 11;
∴ 11 is the greatest number required. Ans.

3. A person invested £2,225 in the 3½ per cents. at 89, and on their rising to 90⅔ sold out; what was his gain?

89 : 1⅔ :: £2,225.

$$\frac{£2,225 \times 15}{89 \times 8} = £46\ 17s.\ 6d. \text{ Ans.}$$

4. Find the true discount on £366 12s. due 1 year 4 mos. at 3 per cent.

Int. of £100 for 16 mos. at 3 per cent. = £4.
Amt. ,, ,, ,, = £104.
∴ 104 : 4 :: £366 12s. : discount required.

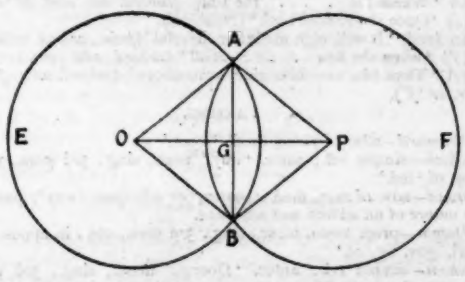
$$\frac{£366\ 12s. \times 4}{104} = £14\ 2s. \text{ Ans.}$$

EUCLID.

1. Construct a triangle whose sides shall be respectively equal to three given straight lines, any two of which are greater than the third (Prop. 22, Bk. I.).

2. Parallelograms on the same base and between the same parallels are equal (Prop. 35, Bk. I.).

3. Two circles whose centres are O and P respectively intersect in A and B. Show that OP bisects AB.



Let the circles ABE, ABF intersect at A and B, and let their respective centres be joined by OP, also let AB be joined. Then AB is bisected by OP in G. Join AO, OB, PA, PB.

Proof.—In the △s AOP, BOP, the two sides AO, OP = the two sides BO, OP, each to each, and the base AP = the base PB; ∴ ∠AOP = ∠BOP.

Again, in the △s AOG, BOG, the sides AO, OB are equal, the side OG common, and the ∠AOG = ∠BOG; ∴ the base AG = the base BG.—Q. E. D.

ALGEBRA.

(*Solve any two of the following questions.*)

1. Resolve into their elementary factors:—

$x^2 - 3x - 28$; $x^6 - 25y^2$;

and simplify $\frac{1}{2x+y} + \frac{1}{2x-y} + \frac{3x}{y^2-4x^2}$

$x^2 - 3x - 28 = (x+4)(x-7)$. Ans.

$x^6 - 25y^2 = (x^3-5y)(x^3+5y)$. Ans.

$$\frac{1}{2x+y} + \frac{1}{2x-y} + \frac{3x}{y^2-4x^2} =$$

$$\frac{2x-y}{4x^2-y^2} + \frac{2x+y}{4x^2-y^2} - \frac{3x}{4x^2-y^2} =$$

$$\frac{x}{4x^2-y^2} \text{ Ans.}$$

2. Solve:—

$$3x - \frac{x-5}{3\frac{1}{2}} = 4\frac{7}{8} - \frac{4-3x}{10} - \frac{177x}{280}$$

Clearing of fractions,

$840x - 80x + 400 = 1365 - 112 + 84x - 177x$.

Transposing, $840x - 80x - 84x + 177x = 1365 - 112 - 400$.

Collecting, $853x = 853$

$x = 1$. Ans.

3. A man pays £10 16s. with 144 coins, consisting of halfcrowns and shillings. Find the number of each.

Let x = No. of halfcrowns.

Then $144 - x$ = No. of shillings.

$\therefore 2\frac{1}{2}x + 144 - x = 216$s.

$5x + 288 - 2x = 432$.

$5x - 2x = 432 - 288$.

$3x = 144$.

$x = 48$ halfcrowns. Ans.

$\therefore 144 - 48 = 96$ shillings. Ans.

GRAMMAR.

1. Give a *general* analysis of the following passage, shewing clearly the relation of the clauses to one another :—

'Then *forward* by a way *which* beaten *broad*,
Led from the territory of false Lemours
To the waste earldom of another earl,
Doorm, *whom* his shaking vassals call'd the *Bull*,
Went Enid with her sullen followers *on*.
Once she look'd back, and *when* she saw him *ride*
More near by many a rood *than yestermorn*,
It well nigh made her cheerful.'

2. Parse *fully* the words in italics in the above passage.

GENERAL ANALYSIS.

(*a*) 'Then forward by a way went Enid' . . . on (*principal*).
(*b*) 'Which beaten broad . . . earl Doorm' (*subord. adj. sent. to* '*a*').
(*c*) 'Whom his . . . the Bull' (*subord. adj. sent. to* '*b*').
(*d*) 'Once she looked back' (*principal*).
(*e*) (and) 'It well nigh made her cheerful' (*prin., co-ord. with* '*d*').
(*f*) 'when she saw . . . rood' (*subord. adv. sent. to* '*e*').
(*g*) 'Than (she saw him ride) yestermorn' (*subord. adv. of compar. to* '*f*').

PARSING.

Forward—adv. of place, mod. 'went.'
which—simple rel., antec. 'way,' neut., sing., 3rd pers., nom., subj. of 'led.'
broad—adv. of man. mod. 'beaten,' or adj. qual. 'way'; partakes the nature of an adverb and adjective.
Doorm—prop. noun, masc., sing., 3rd pers., obj., in appos. with 'earl,' gov. by 'of.'
whom—simple rel., antec. 'Doorm,' masc., sing., 3rd pers., obj., gov. by 'called.'
Bull—prop. noun, masc., sing., 3rd pers., obj., gov. by 'called,' or indir. obj.
on—adv. of place mod. 'went.'
when—subord. conj. introd. subord. adv. sent. of time, and mod. 'saw' as an adv.
ride—str. intrans. verb (*ride, rode, ridden*), infin., pres.; 'to' omitted after 'saw.'
more—adv. of deg. mod. 'near.'
than—subord. conj. introd. subord. adv. sent. of compar.
yestermorn—noun used adverbially mod. (*ride*).

3. The substantive verb, passive verbs of naming, and some denoting actions of the body, require the nominative in the predicate, as—John was king; He is called James; She walks a queen; Jacob became a rich man; She seems a fine girl; Gordon fell a victim to delay.

SECOND PAPER.

(*Three hours allowed for this paper.*)

GEOGRAPHY.

1. Draw a map of the basin of the Danube, marking and naming the chief tributaries and the principal towns. (See any good atlas.)

2. Where are the following and for what noted: *Stettin, Surat, Frankfort, Moorshedabad, Avignon, Allahabad, Prague?*

Stettin—A flourishing seaport of Prussia, on the Oder. It is strongly fortified.

Surat—A city of British India in Bombay Presidency; exports cotton and grain, but its trade is waning before that of Bombay city.

Frankfort, on the Main, formerly a free town of Germany; besides its manufactures, it is the chief emporium of the inland trade of Germany. (There is another town of the same name on the Oder.)

Moorshedabad is a city of British India, in Bengal, of which it was long the capital.

Avignon—A city of France, on the Rhone, in a rich and fruitful plain.

Allahabad is situated at the junction of the Ganges and Jumna, and attracts crowds of pilgrims from all parts of India to bathe in the sacred Ganges.

Prague—A city of Austria, the capital of Bohemia, on the Moldau. It has extensive manufactures and the oldest University.

3. Define these terms :—Equator, Meridian, Parallel of Latitude. Along which of these are latitude and longitude respectively measured? How many degrees of longitude correspond to an hour of time?

The *Equator* is an imaginary line passing round the middle of the earth at an equal distance from the poles, and dividing the globe into the N. and S. hemispheres.

The Meridians are lines drawn on the terrestrial globe, passing through the poles, and are used for measuring longitude. Every country used to have its own first meridian, but the one passing through Greenwich is almost universally used now.

Parallels of Latitude are lines running right round the globe at right angles to the meridians, the middle one being the Equator, from which latitude is reckoned.

Longitude is reckononed in degrees, min. and sec. along the Equator E. or W. of the first meridian, and Latitude is reckoned in degrees, &c. N. or S. of the Equator.

15° of Longitude correspond to an hour of time (360° ÷ 24).

HISTORY.

(*Answer any two of the following questions.*)

1. By what difficulties was Elizabeth surrounded on her accession? What was the state of Ireland during her reign?

On her accession Elizabeth was met by great religious difficulties. Her chief minister, Cecil, encouraged her to overturn the Catholic hierarchy in favour of the reformed doctrines. In her efforts she was thwarted not only by Catholics, but by Puritans. It was against the Catholics that the severest measures were taken, and under a particular Act priests were not only exiled, but executed.

During her reign Ireland was in a state of chronic rebellion; no sooner was one rising quelled than another began. Essex tried to quell the revolt of Hugh O'Neil and lost the Queen's favour.

2. Name the chief ministers of Henry VIII. State briefly what was the chief object of the policy of each Minister.

The first minister of Henry VIII. was *Cardinal Wolsey*, who for many years governed England and acted almost entirely for his own aggrandisement. He opposed Henry's divorce.

Sir Thomas More succeeded Wolsey, opposed Henry's claim to the head of the Church, was removed, and finally beheaded.

Thomas Cromwell advised the King to deny the Pope's supremacy and to suppress the monasteries, but displeased the King in the matter of Anne of Cleves, and was beheaded.

3. Explain what is meant by:—Convention Parliament, Absolute Power, Conventicle, Bill of Attainder, Nonconformists.

A *Convention Parliament* is one that assembles without royal warrant, *e.g.* 1660 and 1689.

Absolute Power is the government by a monarch who is not limited by ministers or by any deliberative assembly, *e.g.* Russia.

Conventicle was the meeting of Nonconformists for religious purposes.

A *Bill of Attainder* is a bill brought in to Parliament against some aristocratic criminal who might escape punishment if tried by the common courts, *e.g.* Strafford and Bishop Atterbury.

Nonconformists were those who did not obey the Act of Uniformity, 1662.

COMPOSITION.

Write a short essay on 'Books,' or on 'The British Navy.'

BOOKS.

Nowadays, with well-stocked libraries and reading rooms at our disposal, there is little difficulty experienced in allowing our love for reading to have full play. When face to face with a large collection of books we are almost bewildered, and feel at a loss to fix upon a volume. There is scarcely an excuse for any family to be without a Bible, a copy of Burns, or Shakespeare. What a blessing is a good book. It is always ready to receive us, and we need only speak to it to be spoken to. We can indulge our love of adventure by accompanying a Livingstone or a Stanley in his stirring experiences without endangering life or limb. We read till our hearts burn within us to emulate their noble deeds. The historian carries us back till we are in the presence of a Cæsar, a Nelson, a Wellington, or a Gordon. Along the broad field of history we travel, listening to kings, statesmen, and philosophers. Carlyle has said these words respecting books: 'Visible and tangible products of the past again I reckon up to the extent of three—cities, tilled fields, and the third is Books. In which third truly, the last invented, lies a worth far surpassing the other two. Wondrous indeed is the virtue of a good book. Not like a dead city of

stones yearly crumbling, yearly needing repair, more like a tilled field, but then a spiritual field. Like a spiritual tree it stands from year to year, ... and yearly comes its new production of leaves, ... every one of which . . . . can persuade man.'

SCHOOL MANAGEMENT.

Describe and comment on the various methods commonly employed for teaching young children the first steps of reading.

The methods commonly employed in teaching young children to read are three in number: (1) The Alphabetic; (2) The Phonic; (3) The Look-and-Say Method.

The first is the most common, and is called alphabetic because it associates the sound of a word with its sign by means of letter names taken either collectively or in syllables. This method is objected to because it inverts the proper relation of reading and spelling.

The second method is that which associates the sound of the word with the letter *sounds* composing it. This method is objected to because it is quite inadequate to meet the complexity of sounds occurring in English words, especially with regard to vowels.

The third method deals with words as a whole, and endeavours to teach reading by calling attention to the general appearance of words. The sounds of words as a whole are associated with their forms as a whole. The method is apt to lead the children to guess at the words, but it is gaining favour with many teachers.

In my opinion the best method is the experienced teacher's own, and will combine the good points of all three methods.

2. Show how you would give a first lesson in vulgar fractions.

In giving a first lesson on fractions I would draw a line upon the board, bisect it, and show that the two parts were equal. I would next divide an apple in a similar manner, noticing that the two halves were equal to the whole. I should continue this process with several objects till the children were quite familiar with wholes and halves. I should follow this up with cutting the line into three and four equal parts, proving always that these three or four divisions made up the whole line, getting them to repeat one half, two halves, one third, two thirds, three thirds, one fourth, etc. I should next question them on how many halves, thirds and fourths there were. Next would follow the signs for these, 1 above 2, and drawing the line between $\frac{1}{2}$ and so on with the others. Then would come the names, fraction, numerator, denominator and numerous exercises, till every one was perfectly clear on the matter.

NEEDLEWORK.

Draw to scale (quarter size) the pattern of a woman's nightdress.

LATIN.

1. Translate:—Caesar singulis *legionibus* singulos legatos et quaestorem praefecit, uti eos *testes* suae quosque virtutis haberet; ipse a dextro cornu, quod eam partem minime firmam hostium esse animadverterat, proelium commisit. Ita nostri acriter in hostes signo dato impetum fecerunt, itaque hostes repente celeriterque *procurrerunt*, ut spatium pila in hostes conjiciendi non daretur. *Rejectis* pilis cominus gladiis pugnatum est. At Germani celeriter ex consuetudine suâ phalange factâ impetus gladiorum exceperunt. Reperti sunt complures nostri milites, qui in phalanges *insilirent* et scuta *manibus revellerent*, et desuper vulnerarent.

TRANSLATION.

Cæsar placed a lieutenant and quæstor over each legion, that every one might have these as witnesses of his valour. He himself began the battle on the right wing, because he perceived that post of the enemy to be the least strong. So fiercely did our men, on the signal being given, make the attack upon the enemy, and so suddenly and rapidly did the enemy charge forward, that time for throwing the spears against the enemy was not given. Their javelins being flung away, they fought hand to hand with swords. But the Germans, a phalanx having been rapidly formed, according to their custom, awaited the attack of the swords; many of our soldiers were found to leap upon the phalanxes, and tear away the shields with their hands and wounded (the enemy) from above.

2. Parse and explain the words in *italics*.

Legionibus—Dat. plur. of legio, —onis, 3rd decl., indir. obj. of 'praefecit.' R.—'Verbs of comparing, giving, etc., govern the dative.'

Testes—Acc. plur. of testis—is 'a witness,' obj. in appos with eos (gov. by 'haberet.') R.—Nouns signifying the same thing agree in case.

Procurrerunt—3rd pers. plur., pret. indic., agr. with subj. 'hostes.' 3rd conj. procurro—curri—cursum—currĕre.

Rejectis—Abl. plur. absolute along with 'pilis.' R.—A substantive and a participle whose case depends upon no other word in the sentence are put in the ablative absolute.

Insilirent—3rd pers. plur., imperf. subj., agr. with subj. 'qui.' 4th conj. insilio—silui—sultum—silire—subj. because in the subord. cl.

Manibus—Abl. plur., fem. 4th decl. manus—ūs. abl. of instrument.

Revellerent.—See insilirent—revello—vulsi—vulsum—vellere. 3rd conj.

3. How is Place Whither expressed in Latin?

Motion towards a place or person is generally expressed by the accusative with a preposition. The only case in which it is expressed by the accusative alone is that of the names of towns and small islands.

4. Translate into Latin:—
(*a*) What is harder than stone; what is softer than a wave?
(*b*) Who would have known Hector, if Troy had been fortunate?
(*c*) Jugurtha arrived at Thala, a great and wealthy city.
(*a*) Quid durius lapide est; quid mollius undâ.
(*b*) Quis Hectorem novisset, si Troja felix fuisset.
(*c*) Jugurtha in Thalam, urbem magnam opulentemque pervenit.

THIRD YEAR.

FIRST PAPER.

(*Two hours and a half allowed for this Paper.*)

DICTATION AND PENMANSHIP.

(*Same as First Year.*)

ARITHMETIC.

MALES.

(*Solve any two of the following questions.*)

1. After a certain number of men had been employed on a piece of work for 27 days, and had half finished it, 16 men more were put on, and the remaining half was completed in 18 days. How many men were employed at first?

1st No. do $\frac{1}{54}$ of the whole daily, or $\frac{2}{108}$ parts.
1st No. + 16 do $\frac{1}{36}$ of the whole daily, or $\frac{3}{108}$ parts.
∴ the 16 do of the whole daily $\frac{1}{108}$.
Hence $\frac{1}{108} : \frac{2}{108}$ :: 16 : No. required.

$$\frac{16 \times 2 \times 108}{1 \times 108} = \underline{32} \text{ men.} \quad \text{Ans.}$$

2. A wholesale dealer sells to a retailer at 30 per cent. profit, and the retailer to the customer at 50 per cent. profit; what per centage of the price paid by the consumer is profit?

Let 100 represent the prime cost.
Then 130 represents the price paid by dealer,
And 50% on 130 is 195,
That is, what cost 100 finally costs 195.
∴ there is a gain of $\underline{95\%}$ Ans.

3. A merchant bought goods abroad: the cost of freight and insurance was 15 per cent., and the duty 10 per cent. on the original outlay. He was obliged to sell them at a loss of 5 per cent., but if he had got £3 more for them, he would have gained 1 per cent. on the total cost. Find his original outlay.

Let P = prime cost.
Then $\frac{125}{100}$ P represents price to importer.
He sells $\frac{125}{100}$ P at a loss of 5 per cent.
∴ $\frac{125}{100}$ P × $\frac{95}{100}$ = $\frac{95}{80}$ P = $\frac{19}{16}$ P.
If he had got £3 more than $\frac{95}{80}$ P, he would have made $\frac{101}{100}$ P of $\frac{125}{100} = \frac{101}{80}$.
Hence $\frac{101}{80}$ P − $\frac{95}{80}$ P = £3.
$\frac{205}{400}$ P − $\frac{475}{400}$ = £3.
$\frac{30}{400}$ P = £30 ∴ P = $\underline{£40}$. Ans.

FEMALES.

1. If 75 men can do a piece of work in 12 days of 10 hours each, how many men, working the same number of hours a day, will perform a work twice as large in a tenth part of the time, supposing that two of the second set can do as much work in an hour as three of the first set.

1 time : 10 times
1 work : 2 works
3 men : 2 men
} :: 75 : $\underline{1,000}$ men. Ans.

2. The true discount on £736 15s., due at the end of 15 months, is £35 1s. 8d. At what rate per cent. is interest allowed?

£736 15s.—£35 1s. 8d. = £701 13s. 4d. P.R.
£701$\frac{2}{3}$: £35$\frac{1}{12}$
15 mos. : 12 mos.
} :: £100 : rate.

$$\frac{£100 \times 421 \times 3 \times 12}{2105 \times 15 \times 12} = \underline{4}\% \quad \text{Ans.}$$

3. A person expends £1,125 in railway shares when they are 6¼ per cent. discount, and sells them again at 8¼ per cent. premium, what does he gain by the transaction?

$$93\tfrac{3}{4} : 108\tfrac{1}{4} :: £1,125 : x.$$
$$\frac{£1,125 \times 433}{375} = £1,299.$$
$$£1,299 - £1,125 = \underline{£174} \text{ gain. Ans.}$$

4. A merchant's losses during 4 years average 3¾ per cent. upon his original capital, and at the end of the four years his capital is £2,783 15s., what was it at first?

His total loss is 15 %.

$$\therefore 85 : 2783\tfrac{3}{4} :: £100 : x.$$
$$\frac{£100 \times 11135}{85 \times 4} = \underline{£3,275}. \text{ Ans.}$$

EUCLID.

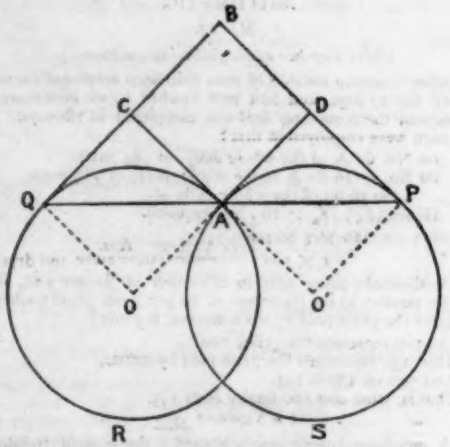
1. In an obtuse-angled triangle, the square subtending the obtuse angle, etc.

Prop. 12. Bk. II.

2. In equal circles, angles at the centres or at the circumferences, which stand upon equal arcs, are equal.

Prop. 27. Bk. III.

3. Two circles intersect in A, and through A is drawn a straight line, meeting the circumferences again in P and Q. Prove that the angle between the tangents at P and Q is equal to the angle between the tangents at A.



Let O and O¹ be the centres and join OQ, OA, O¹P, O¹A.
Then ∠ DPO¹ = ∠ DAO¹ = ∠ CAO = ∠ CQO = R ∠.
∠ APO¹ = ∠ PAO¹. Since O¹A = O¹P.
∴ ∠ DPA = ∠ DAP. Axiom.
In same way ∠ CQA = ∠ CAQ.
∴ ∠ DPA + ∠CQA = ∠ DAP + ∠ CAQ, but ∠s BPA + BQA + QBP = 2 R∠s, and ∠s at Pt. A = 2 R∠s.
Parts of these are equal ∴ &c.

$$\angle CAD = \angle QBP.$$

ALGEBRA.

(Solve any two of the following questions.)

1. Factorize $28x^2y^2 - 224x^2y^5$; $4a^2b^2 - 1 - a^4 - 2a^2$; and simplify

$$\frac{3(x^2+x-2)}{x^2-x-2} + \frac{3(x^2-x-2)}{2-x-x^2} + \frac{8x}{4-x^2}.$$

(a) $28x^2y^2 - 224x^2y^5 = 28x^2y^2(x^3 - 8y^3)$
$= \underline{(7xy)(4xy)(x-2y)(x^2+2xy+4y^2)}$. Ans.

(b) $4a^2b^2 - 1 - a^4 - 2a^2 = 4a^2b^2 - (a^4 + 2a^2 + 1)$
$= 4a^2b^2 - (a^2+1)(a^2+1)$
$= \underline{(2ab + a^2 + 1)(2ab - a^2 - 1)}$. Ans.

(c) $\dfrac{3(x^2+x-2)}{x^2-x-2} + \dfrac{3(x^2-x-2)}{2-x-x^2} + \dfrac{8x}{4-x^2} =$

$$\frac{3(x^2+x-2)^2 - 3(x-x-2)^2 - 8x(x+1)(x-1)}{(x+1)(x-1)(x+2)(x-2)} =$$
$$\frac{3(4x^2-8x) - 8x^3 - 8x}{(x^2-1)(x^2-4)} =$$
$$\frac{12x^2 - 24x - 8x^3 + 8x}{(x^2-1)(x^2-4)} =$$
$$\frac{4x^3 - 16x}{(x^2-1)(x^2-4)} =$$
$$\frac{4x(x^2-4)}{(x^2-1)(x^2-4)} = \frac{4x}{x^2-1}. \text{ Ans.}$$

2. Solve:—

(i.)
$$\left.\begin{aligned} \frac{x}{a} - \frac{y}{b} &= 1 \\ \frac{x}{b} + \frac{y}{a} &= \frac{a}{b} \end{aligned}\right\}$$

(ii.) $\dfrac{7}{x+4} + \dfrac{1}{4-x} = 1\tfrac{3}{8}$.

(i) $\dfrac{x}{a} - \dfrac{y}{b} = 1$; or, $bx - ay = ab$

$\dfrac{x}{b} + \dfrac{y}{a} = \dfrac{a}{b}$; or, $ax + by = a^2$.

Multiplying 1st equation by b we get $b^2x - aby = ab^2$.
,, 2nd ,, a ,, $a^2x + aby = a^3$.
Adding these ,, $a^2x + b^2x = a^3 + ab^2$
$\therefore x = \underline{a}$. Ans.

(2) Substituting a for x in 1st.
$ab - ay = ab$
$ay = ab - ab$
$y = \underline{0}$. Ans.

(ii.) $\dfrac{7}{x+4} + \dfrac{1}{4-x} = 1\tfrac{3}{8}$

$28 - 7x + x + 4 = \frac{3}{8}(16 - x)^2$
$32 - 6x = \frac{3}{8}(16 - x)^2$
$96 - 18x = 80^3 - 5x$
$5x^2 - 18x = -16$
$x^2 - \dfrac{18x}{5} + \dfrac{81}{25} = -\dfrac{16}{5} - \dfrac{81}{25} = \dfrac{81}{25} - \dfrac{80}{25} = \dfrac{1}{25}$.
$x - \frac{9}{5} = \pm\frac{1}{5}$
$x = \frac{9}{5} \pm \frac{1}{5} = \underline{2}$ or $\underline{1\frac{3}{5}}$. Ans.

3. A cyclist rode 240 miles at a uniform rate; but if he had ridden 4 miles an hour slower than he did, it would have taken him 5 hours longer. Find his rate per hour.

Let x = miles per hour.
Then $\dfrac{240}{x}$ = Number of hours.
$x - 4$ = miles at slower rate,
$\dfrac{240}{x-4}$ = number of hours at slower rate.
$\therefore \dfrac{240}{x-4} - \dfrac{240}{x} = 5$ hours.
$240x + 960 - 240x = 5x^2 - 20x$
$5x^2 - 20x = 960$
$x^2 - 4x = 192$
$x^2 - 4x + 4 = 196$
$x - 2 = \pm 14$
$x = 2 \pm 14 = \underline{16}$ Ans.

FEMALES.

(Solve any two of the following questions.)

1. Simplify $\dfrac{x^2-2x}{x^2-x} - \dfrac{x+3}{x+1} + \dfrac{4x}{1-x} =$

$$\frac{x^2-2x}{x^2-1} - \frac{x+3}{x+1} + \frac{4x}{x-1} =$$
$$\frac{(x^2-2x) - (x-3)(x-1) + 4x(x+1)}{x^2-1} =$$
$$\frac{x^2 - 2x - x^2 - 2x + 3 + 4x^2 + 4x}{x^2-1} =$$
$$\frac{4x^2+3}{\underline{x^2-1}}. \text{ Ans.}$$

and resolve into their elementary factors—

$x^3 - 1 - x^2 + x$ and $a^2 - b^2 - (a-b)^2$.

(a) $x^3 - 1 - x^2 + x = (x^3 - 1) - (x^2 - x)$
$= (x-1)(x^2 + x + 1) - x(x-1)$
$= (x-1)(x^2 + x + 1 - x)$
$= \underline{(x-1)(x^2+1)}$. Ans.

(*b*) $a^2 - b^2 - (a-b)^2 = (a+b)(a-b) - (a-b)(a-b)$
$= (a-b)\{(a+b) - (a-b)\}$
$= \underline{(a-b)\,2b}$. Ans.

2. Solve—

(i) $\frac{x+9}{4} - \frac{3x-6}{5} = 3 - \frac{2x}{7}$.

$35x + 315 - 84x + 168 = 420 - 40x$
$75x - 84x = 420 - 483$
$9x = 63$
$x = \underline{7}$. Ans.

(ii) $a(x+a) + b(b-x) = 2ab$
$ax + a^2 + b^2 - bx = 2ab$
$ax - bx = 2ab - a^2 - b^2$
$bx - ax = b^2 - 2ab + a^2$
$x = \underline{b-a}$. Ans.

3. £22 was paid with 48 coins, some of which were sovereigns, three times as many were half-sovereigns, and the rest half-crowns. Find the number of each.

Let x = sovs.
then $3x$ = half-sovs.
$48 - 4x$ = half-crs.
$20x + 30x + 2\frac{1}{2}(48 - 4x) = 440$s.
$50x + 120 - 10x = 440$
$40x = 320$
$x = 8$ sovs.
$3x = 24$ half-sovs.
$48 - 32 = \underline{16}$ half-crs.

GRAMMAR.

1. Give a general analysis of the last five lines of the following passage, showing clearly the relation of the clauses to one another :—

'To suffer, *as* to do,
Our strength is equal ; nor the law unjust
That so ordains. *This* was at first resolved,
If we *were* wise, against so great a foe
Contending, and *so* doubtful *what* might fall.
I laugh when those who at the spear are bold
And venturous, if that fail them, shrink and fear
What yet they know must follow—*to endure*
Exile, or ignominy, or bonds, or pain,
The *sentence* of the conqueror.'

2. Parse fully the words in italics in the above passage.

General Analysis.

(*a*) 'I laugh' (*principal sent.*)
(*b*) 'when those shrink' (*subord. adv. sent. to* '*a*').
(*c*) '(when those) fear' (*subord. adv. sent. to* '*a*').
(*d*) who at the spear are bold and venturous (*subord. adj. sent. to* '*b*' *and* '*c*').
(*e*) 'if that fail them' (*subord. adv. cond. to* '*b*' *and* '*c*').
(*f*) 'what yet must follow—to endure . . . conqueror' (*subord. noun sent. obj. of* '*c*' *and* '*g*').
(*g*) 'they know' (*subord. adj. sent. to* '*what*' *in* '*f*').

Parsing.

1. *as*—subord. conj., introd. the subord. sent. 'it is equal to do.'
that—simple rel. antec. 'law,' 3rd pers. sing., neut., nom., subj. of 'ordains.'
so—adv. man., mod. 'ordains.'
this—demons. pro. referring to the sense before it, neut., sing., 3rd pers., nom., subj. to 'was resolved.'
were—intrans. verb 'to be,' subj. past, 1st pers. pl., agree, sub. 'we.'
so—adv. of degree, mod. 'doubtful.'
what—comp. rel. pro. equal to 'that which'; 'that' is obj., gov. by ('of'), 'which' is in the nom., subj. of 'might fall.'
what—comp. rel. pro. equal to 'that which'; 'that' is obj., gov. by 'shrink' and 'fear,' 'which' stands for the obj. of 'know,' and subj. of 'must follow.'
yet—adv. of time, mod. 'must follow.'
to endure—trans. wk. verb, infin. pres.
sentence—com. noun, neut., sing., 3rd pers., in appos. to all the objects of 'endure,' *e.g.* exile, ignominy, bonds, pain.

3. Enumerate, with examples, the prefixes of Saxon origin.

The principal Saxon prefixes are :—
A, on : aboard, abed, a-building.
A, from : adown, akin, athirst.
After, after : afternoon.
Be, (1) for : bemoan ; (2) over : besmear ; (3) to make : befriend ; (4) off : behead.
En, in, make : enable, embark.
For, through : forgive ; against : forbid, forget.
Fore, before : foresee, forenoon.
Mis, wrong : misdeed, mislead.
Over, too much : overflow.
To, this, the : to-day, to-morrow.
Un, not : unclean, unkind.
Un, back : undo, unfold, unlock.
Up, up : upset.
With, against : withstand.

Second Paper.

(*Three hours allowed for this Paper.*)

GEOGRAPHY.

1. Draw a map of *Australia*, showing and naming the physical features and chief towns. (Any good atlas will show this).

2. Describe the course of a ship from Calcutta to Japan.

Starting from Calcutta, capital of British India, we go down the Hoogly, having on each side the dreaded 'Sunderbuns,' and enter the Bay of Bengal, through which we may proceed in a S.E. direction to Rangoon, at the mouth of the Irrawady, and thence to Singapore, calling on the way at Mergui and Penang. Discharging our cargo at this great *entrepôt*, we load a very miscellaneous cargo and continue our voyage N.E. past Siam to Hong Kong, where we make a short call at Victoria. Leaving this city, we steer our course to Shanghai, and, after interchanging commodities, we double the southern extremity of the Japan Islands, and make all speed for Yokohama.

3. Distinguish between 'Climate' and 'Weather.' What influence have vegetation and draining of land on temperature?

Climate is the average of weather conditions for a year. Weather varies almost every day. If there is more rainy weather than dry, a country is said to have a wet climate ; and if it has more dry than wet weather, then a country is said to have a dry climate.

Vegetation, like forests, modifies the heat of the sun during the day, and prevents very rapid radiation during the night, and thus tends to equalise the temperature, but it has also a cooling effect, being often associated with marshy land.

The effect of draining is to increase the temperature and dryness ; in fact, the increase in temperature due to drainage in Great Britain during the last hundred years is said to be from two to three degrees.

HISTORY.

(*Answer any two of the following Questions.*)

1. What constitutional questions were advanced by the failures of Government action against John Wilkes?

The action against Wilkes decided that general warrants were illegal, but the real constitutional points were (1) privileges of members of Parliament, and (2) the right of constituencies to choose their own members. A great impetus was given to the question of Parliamentary Reform, and to the claim that the press should be allowed to report the debates of the House of Commons.

2. Write short notes on :—*The Patriots, the Talents, the Budget, the Luddites, a Federal Government, One Man, One Vote.*

The Patriots were a party who opposed Walpole in his financial reforms.

The Talents—The Government of Lord Grenville (1806) was called the Ministry of all the Talents.

The Budget is the annual financial statement of the English Chancellor of the Exchequer or his speech, giving a review of the public revenue and expenditure.

The Luddites were a body of men banded together to destroy machinery, which they thought prevented them from getting their daily bread.

A Federal Government is such a government as that of the U.S. of America. Many politicians are favourable to such a federation among the various states of the British Dominions.

One Man, One Vote means that no man should have more than one vote. This cry is raised against those who have votes on property in different constituencies.

3. What do you understand by the Eastern Question? In what form was it raised (*a*) in the reign of George IV. ; (*b*) at the time of the Crimean War?

The Eastern Question refers to Russia's pursuing a course of aggrandisement at the expense of Turkey. In the reign of George IV. the Greeks took up arms for their independence, as they were oppressed by the Turks, assisted by an Egyptian fleet. At Navarino the fleets of England, France, and Russia, under Codrington, destroyed the enemy's fleet.

At the time of the Crimean War the Russians, aiming at the possession of Constantinople, and making a pretext of quarrel out of Turkey's treatment of her Christian subjects, invaded Turkey. England and France united in favour of Turkey, and the scene of the war was laid in the Crimea.

COMPOSITION.

Write an essay on 'The Invention of Printing,' or on 'The Clothing of Animals.'

The Invention of Printing.

The grand event of the fifteenth century was the introduction into England of the art of printing. Invented in Holland and improved in Germany, it passed through the stages of letters cut in wooden blocks and of types in cut metal to that of movable types of cast metal. These movable types gave the art its immense practical value for the swift reproduction and wide diffusion of the lessons of the past and the thought of the present. In 1477 William Caxton, assisted by Earl Rivers and Edward IV., set up at Westminster the first printing-press of England. The first work he printed is said to have been a treatise on the Game of Chess. A few years afterwards, at the very close of the Plantagenets, the Acts of Parliament were first printed, and the laws, for the first time since the Norman Conquest, were drawn up in the English tongue.

SCHOOL MANAGEMENT.

1. What methods would you employ in teaching Composition?

In teaching Composition, the earlier children are trained to answer in complete sentences the better. In Standards I. and II. simple subjects should be given to which predicates are to be put, and, if possible, objects should be obtained. In Standard III. as many sentences as possible should be asked from the scholars on such subjects as *the horse, the cow, the sheep*, and requiring these sentences to be of a fair length. In Standard IV. the formation of complex sentences may be begun, assisting the pupils by suggesting the introduction of such words as *when, while, where, etc.*, which begin subordinate clauses. A simple and interesting story may now and then be given for reproduction, to interest them in this most difficult branch of elementary education. By careful supervision of the class while engaged in this exercise, and with a little judicious assistance, very satisfactory results are obtained.

2. Write notes of a lesson on any useful plant.

WHEAT.

Objects to be seen.—Stalk of wheat, bearing its ear of seeds—chaff—wheat grains, free from chaff—bran—flour—biscuit—other bread made from flour—maps.

Cultivation of Plant.—Ploughing, sowing, in spring or autumn—harrowing, rolling—first appearance of plant—ripe in about seven months—cutting by scythe, sickle, machine—sheaves collected—piled up with heads upwards till thoroughly dried—stacked and kept till required for use.

Manufacture.—Wheat threshed by a flail (*describe*)—or in mills—to separate grain from ear—and shake off husk or *chaff*—grain and chaff winnowed (*describe*)—steam mills often used—wheat now taken to mill and ground between two large stones (*describe*)—grains when put in have a skin—this comes off unground and is called bran (*show*). Bran and wheat mixed are whole-meal—bran when sifted leaves flour much whiter—flour made finer by sifting—sieves (*describe*).

Uses.—Important article of food—made into many kinds of bread (ask for names of these)—starch—bran for feeding horses, cows, etc.—*bran* and flour make *brown bread*—straw, used for bedding, mattresses, thatching, etc.—chaff also used for same purposes.

Where grown.—England, Russia, France, United States, New South Wales—has the best in the world—Prussia, Egypt, and in most temperate regions; imported in great quantities from various countries to supplement the British crop.

NEEDLEWORK.

Cut out and tack together a child's frock bodice (paper).

Make a button-hole on a piece of print, representing one of the back pieces of a frock bodice.

LATIN.

1. Translate:—

Eodem fere tempore P. Crassus, cum in Aquitaniam pervenisset, quae pars, ut ante dictum est, et regionum *latitudine* et multitudine hominum ex tertiâ parte Galliae est aestimanda, cum intellegeret, in his locis *sibi* bellum gerendum, ubi paucis ante annis L. Valerius Praeconius legatus exercitu pulso *interfectus esset* atque unde L. Mallius procensul impedimentis amissis *profugisset*, non mediocrem sibi diligentiam *adhibendam intelligebat*. Itaque re frumentariâ *provisâ*, *auxiliis* equitatuque comparato, multis praeterea viris fortibus Tolosâ et *Narbone*, quae sunt civitates Galliae provinciae finitimae ex his regionibus, nominatum evocatis in Sontiatum fines exercitum introduxit.

Translation.

Almost at the same time Publius Crassus, when he had come into Aquitania, which quarter, as has been before stated, is to be reckoned, from the extent of the country and from the number of inhabitants, as the third division of Gaul, when he learned that war was to be waged by himself in those places, where a few years before Lucius Valerius Praeconius the lieutenant had been slain, his army having been routed, and from whence Lucius Manilius the proconsul had fled, his baggage having been lost, he perceived that no moderate diligence was to be exerted by him. Accordingly, corn having been provided, auxiliaries and cavalry having been procured, moreover, many brave men having been summoned by name from Tolosa and Narbo, which are states of the Province of Gaul, bordering on these countries, he led his army into the territories of the Sontiates.

2. Parse the words *in italics*, conjugating the verbs, and accounting for the case and mood used.

Parsing.

Latitudine.—abl. sing. of 'cause,' from latitudo—dinis.

Sibi.—Dat. sing. from sui—sibi; def. pron., agent of the gerundive 'gerendum.'

Interfectus.—past part., pass. (interficio—feci—fectum—ficere); forming with

Esset.—3rd pers. sing., plup. subj., pass. (subord. clause), agr. with subj. 'L. V. Praeconius.'

Profugisset.—3rd pers. sing., plup. subj., in subord. cl., from profugio—fugi—fugitum—fugere, agr. with L. Mellius.

Adhibendam.—gerundive of adhibeo—ui—itum—ēre, agr. with 'diligentiam.'

Intelligebat.—3rd pers. sing., imperf. indic., agr. with (*ille*), from intelligo—exi—ectum—ere.

Provisâ.—abl. sing. absol. with 're,' from provido—vidi—visum—vidēre.

Auxiliis.—abl. plur. absol., with (comparatis) auxilia—orum.

Narbone.—abl. sing., from Narbo—nis; from a place is put in the ablative.

3. Translate into Latin:—

The ambassadors threw themselves at the feet of Cæsar and sought peace with tears. He ordered the Helvetii to await his arrival at the place where they then were. When he arrived there he ordered them to send back the slaves who had fled to them, and demanded hostages. On the following night 6,000 men went out of the camp of the Helveltii and hastened to the Rhine.

Translation into Latin.

Legati se Caesaris ad pedes projecerunt et flentes pacem petierunt. Helvetios in eo loco quo tum essent suum adventum expectare jussit. Eo postquam pervenit, uti servi qui ad eos profugissent, remitterentur imperavit et obsides poposcit. Nocte intermissa hominum sex millia e castris Helvitiorum egressi atque ad Rhenum contenderunt.

MENSURATION.

(*Solve one of the following Questions.*)

1. A street that is $\frac{11}{20}$ of a mile long and 18 yards wide, has on each side a footway $10\frac{1}{2}$ feet broad; what will it cost to pave the footway with flags, at 3s. 6d. per square yard, and the carriage-way with limestone at 2s. 3d. per square yard!

$$\text{Area of footway} = 2 \frac{(10\frac{1}{2} \times \frac{11}{20} \text{ of } 5280)}{9} \text{ sq. yds.}$$
$$= \frac{21 \times 11 \times 264}{9}$$
$$= 6776 \text{ sq. yds.}$$

6776 sq. yds. at 3s. 6d. = £1185 16s. Cost of Footway.

$$\text{Area of Carriage-way} = 11 \times \tfrac{11}{20} \text{ of } 1760$$
$$= 11 \times 11 \times 88$$
$$= 10648 \text{ sq. yds.}$$

10648 sq. yds, at $2\frac{1}{4}$s. = £1197 18s. Cost of Carriage-way.

1185 16s.

Total Cost = £2383 14s. Ans.

2. A greenhouse is 12 yards long and 5 yards wide, and the back wall is 11 ft. 3 in. higher than that in front. Find the area of the roof.

$$\text{Slope of roof} = \sqrt{(11{\cdot}25 \text{ ft.})^2 + (15 \text{ ft.})^2}$$
$$= \sqrt{126{\cdot}5625 + 225}.$$
$$= \sqrt{351{\cdot}5625}.$$
$$= 18{\cdot}75 \text{ ft.}$$
$$= 6\tfrac{1}{4} \text{ yds.}$$
$$\therefore \text{Area of roof} = (6\tfrac{1}{4} \times 12) \text{ yds.}$$
$$= 75 \text{ sq. yds.} \quad \text{Ans.}$$

(*The completion will appear in our next Issue.*)

it, paraphrase it, analyse it, parse it, derive its constituent words. Understand its allusions and search out parallel passages from other poets.

Then say it to yourself, to your head-teacher, to the fields and hills, and lastly declaim it to the Inspector. So shalt thou have exhilarating marks.

EXAMINATION PRACTICE.

Many teachers of superior capabilities and wider knowledge suffer themselves to be surpassed in examinations on account of lack of practice in answering questions.

Everyone, without exception, should answer an examination paper, such as we append, at least once a month.

These may be examined, commented upon, and solutions supplied for half-a-guinea per annum paid in advance.

Address—

Dr. G. BEACH, M.A.,
Examination Editor of 'Practical Teacher,'
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A Prize Scheme will also be established in connection with this class.

FIRST YEAR.

1. Reduce $\frac{3}{17}$ of £1 6s. 8d. + $\frac{5}{13}$ of half a guinea + $\frac{4}{17}$s. + $\frac{9}{17}$ of £1 to the fraction of £2 11s. 5d. Ans. $\frac{1}{2}$.

2. When 582167 is divided by a certain number, the quotient is 762 and the remainder 761, what is the number. Ans. 763.

3. (*Boys only.*) Multiply 28·75 by 32·8 and divide the result by 8·495. Ans. 111.

In the decimals equivalent to $\frac{5}{8}$ and $\frac{9}{125}$ why are there three places?

(*Girls only.*) What must be added to $1\frac{1}{4} - 3\frac{1}{2} + 1\frac{1}{5}$ to make $\frac{1}{12} - \frac{33}{44} + \frac{11}{11}$? Ans. $\frac{81}{220}$.

4. Write in *large-hand* the words *Fabrication*, *Theosophist*, *Heavenly*, *Kyanize*.

Write in *small-hand*,

'But such a tide as moving seems asleep,
Too full for sound or foam.'

5. Analyse the following lines and parse the italicised words :—

Roll *on*, *thou* deep and *dark* blue Ocean—*roll!*
Ten thousand fleets sweep over *thee* in *vain;*
Man *marks* the Earth with ruin—*his control*
Stops *with* the shore. Upon the *watery plain*
The wrecks *are all* thy *deed.*—*Byron.*

6. State the meanings of the suffixes of the appended words :—dullard, kingcraft, freedom, kitten, fuller (noun), Godhead, mankind.

7. Write an account of Earl Godwin.

8. Draw a map of Scotland.

9. Enumerate the British Coalfields with their chief towns.

10. How are Deltas formed? What conditions are favourable to their formation? Give examples.

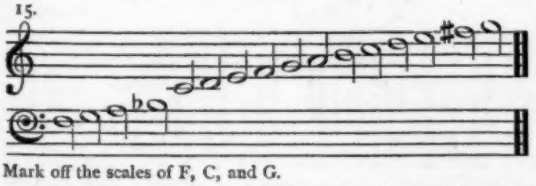
11. What do you know of '*The Danelagh*,' '*Danegelt*,' and '*Romescot.*'

12. Write a life of Dunstan, Julius Cæsar, *or* Harold II.

13. Write Notes of a Lesson on the Teaching of Addition of Money.

14. How are Adjectives compared in Latin *or* French?

15.



Mark off the scales of F, C, and G.

What do you mean by '*The Standard Scale of Pitch*,' *Pulse*, *Accent*, *Measure*?

SECOND YEAR.

1. Find the L. C. M. of $3\frac{1}{3}$, $4\frac{1}{4}$, $5\frac{1}{5}$. Ans. 2,210.

2. Reduce $\frac{11}{119}$ and $\frac{13}{143}$ to a common *numerator*, and determine which is the greater. Ans. $\frac{13}{119}$.

3. (*Boys only.*) What is the yearly income from £3,139 10s. invested in the Two and Three-quarter per Cents at $94\frac{1}{2}$? (Neglect brokerage.) Ans. £91.

(*Girls only.*) A dealer has six kinds of tea, averaging each 2s. 8d. per lb. Four of them cost respectively 1s. 11d., 2s. 3d., 2s. 7d., and 3s. 5d. per lb. What was the cost of the fifth and sixth teas, supposing that one cost three-fourths as much as the other? Ans. 3s. 4d. and 2s. 6d.

4. As in First Year.

5. Paraphrase :—

'*Ere* in the northern gale
The *Summer* tresses of the trees *are gone*,
The *woods* of Autumn *all* around *our vale*
Have put their *glory on.*

The mountains *that* infold
In their wide sweep the coloured *landscape round*,
Seem groups of giant *kings* in purple and gold,
That guard the enchanted ground.'—*Bryant.*

6. Analyse the last four lines and parse all the italicised words.

7. What do you mean by Copulative, Reflexive, and Defective Verbs? Give examples.

8. Draw a map of France.

9. Give particulars respecting the plains of Europe.

10. State approximately the latitude of Calcutta, London, Sophia, Rome, Candy, and the Maelstrom.

11. Describe the Scottish War of Independence against the 'first two Edwards.'

12. State what you know of Wiclif, the Good Parliament, the Wonderful Parliament, and The Great Schism.

13. Write out Euclid I., 22.

Given two sides and the *median* between them, construct the triangle.

Give rules for scouring and dusting a room.

14. Compare *cita*, *facilus*, *frugi*, *grandis*, *prope*, *tener*, and decline in the singular *quilibet*, *alius*, and in the plural *ego*, *alter.*

Give the meanings of *ou* and *où*, *sol* and *soleil.* Write in full the present subjunctive of *moudre.*

15. How far should mechanical aids be allowed in teaching addition and subtraction?

16. Give four bars each of $\frac{3}{8}$, $\frac{6}{8}$ and $\frac{9}{8}$ time.

How are quarters and thirds of a pulse denoted? Give examples containing rests.

THIRD YEAR.

1. A grocer mixes tea at 4s. per lb. with tea at 2s. 3d. per lb., and by selling at 3s. per lb., neither gains nor loses. In what ratio does he mix the kinds of tea? Ans. As 3 : 4.

2. How much apart will the fingers of a watch be at 10 minutes to 1? Ans. $14\frac{1}{2}$ mins. or 85°.

3. (*Boys only.*) If the discount on £42 18s. 4d. for a certain time at $4\frac{1}{2}$ per cent. per annum be £1 5s. 0d., find the time. Ans. 8 months.

(*Girls only.*) What must be paid for 75 miles, 1,056 yards of cable at 4s. $1\frac{1}{2}$d. for $5\frac{1}{2}$ yards? Ans. £4,989 12s. 0d.

4. As in First Year.

5. Paraphrase :—

'To be, or *not to be*,—*that* is the *question*;—
Whether 'tis *nobler* in the mind *to suffer*
The slings and arrows of outrageous fortune;
Or to take arms against a sea of troubles,
And by *opposing end* them? To die,—*to sleep*,—
No more;—and, by a sleep to say we end
The heartache, and the thousand natural shocks
That flesh is heir *to*,—'tis a consummation
Devoutly *to be wished.*'—*Shakespeare.*

6. Analyse the foregoing lines and parse the words in italics :—

7. Give rules as to the use of *—ize*, *—ise*; *—us*, *—ous*; *—ious*, *—tous*; *—ing*, *—cing*; *—ant*, *—ent.*

PUPIL TEACHERS' ROUTINE FOR MAY, 1893.

DAYS	YEARS	FIRST WEEK			SECOND WEEK			THIRD WEEK			FOURTH WEEK		
		First Lesson	Second Lesson	Third Lesson	First Lesson	Second Lesson	Third Lesson	First Lesson	Second Lesson	Third Lesson	First Lesson	Second Lesson	Third Lesson
MONDAY	1	Analysis and Parsing	Measures and Multiples. Practice	Literature, Repetition, and Writing	English from Text Book	How to teach Reading	History from 78 to 121 A.D.	Analysis and Parsing	How to teach Writing	Geography of British North America	Paraphrasing	How to teach Arithmetic	Physical Geography of Mountains
	2		Theory of Proportion. Multip. of Vulgar Fractions				History from 1087 to 1206 A.D.			Geography of India			Longitude
	3		Square Root Addition and Subt. of Decimals			How to teach Geography	History from 1510 to 1535 A.D.		How to Teach Grammar	Geography of Africa		How to teach Composition	Winds
TUESDAY	1	½ of Euclid's Def. Book I. Garment with req. stitches	Geography of England	Scripture or Revision	½ of Euclid's Def. Garment with req. stitches	Geography of England	Scripture or Revision	Post. & Ax. of Euc. Book I. Garment with req. stitches	Any Revision	Scripture or Revision	Euclid Book I., Prop. 1. Stocking-hole Mending	Add. of Algebra. Garment with required stitches	Scripture or Revision
	2	½ of Euclid's Def. Book I. Garment with req. stitches	Geography of Europe		All Euclid's Def. Garment with req. stitches	Geography of Europe		Props. 1 & 2 Euclid Book I. Garment with req. stitches			Euclid Book I., Props. 3, 4. Calico Patch	Subt. of Algebra. Garment with required stitches	
	3	Revise first 13 Props. Garment with req. stitches	Geography of Asia		Revise first 26 Props. Garment with req. stitches	Geography of Asia		Props. 29, 30, Euc., Book I. Garment with req. stitches			Euclid Book I., Props. 31, 32. Hedge-tear Darn	Multip. of Algebra. Garment with required stitches	
WEDNESDAY	1	History from 55 B.C. to 78 A.D.	Introductory Algebra to end of Addition. Garment with the required stitches	Any Advanced Work	Dates and main facts from 55 B.C. to 121 A.D.	Composition	Any Advanced Work	History from 121 to 410 A.D.	English from Text Book	Any Advanced Work	History from 410 to 787 A.D.	Prefixes, Roots or Affixes	Subtraction of Vul. Fractions. Bills of Parcels
	2	History from 1066 to 1087 A.D.			Dates and main facts from 1066 to 1106 A.D.			History from 1106 to 1153 A.D.			History from 1153 to 1189 A.D.		Compound Proportion. Complex Fractions
	3	History from 1485 to 1510 A.D.			Dates and main facts from 1485 to 1535 A.D.			History from 1535 to 1553 A.D.			History from 1553 to 1572 A.D.		Present Worth Reduc. of Vul. to Dec. Fractions
THURSDAY	1	Simple Practice	Introductory Algebra to end of Addition. Garment with the required stitches	Map of England	Addition and Subtraction of Algebra. Garment with required stitches	Euclid Definitions, Book I. Garment with req. stitches	Any Revision	Political Map of England	Composition or Paraphrasing	Literature, Repetition, and Writing	Geography of England	Literature of Anglo-Saxon Period	Any Revision
	2	Mixtures. The different kinds of Vulgar Fractions		Map of France		Post and Axioms, Book I. Garment with req. stitches		Map of France			Geography of Europe	Literature of Norman Period	
	3	Square Root Multiplication of Decimals		Map of India		28 Props., Book I. Garment with required stitches		Map of India			Geography of Asia	Literature of Tudor Period	
FRIDAY	1	Measures and Multiples, Practice	Examination		Common Denom., Bills of Parcels, and Lowest Terms	Examination		Addition of Vulgar Fractions. Practice	Examination		Dates and main facts from 121 to 410 A.D.	Examination	
	2	Simple Proportion Division of Fract.			Simple Proportion Multiplication of Vulgar Fractions			Comp. Proportion Division of Vulgar Fractions			Dates and main facts from 1106 to 1189 A.D.		
	3	Mensuration of Squares. Division of Decimals			Mensuration of Rects. Mult. and Div. of Decimals			Equat. of Paymts. Reduct. of Vulgar Fract. & Decimals			Dates and main facts from 1535 to 1572 A.D.		
SATURDAY	1	French or Latin	Science	Freehand Drawing or Geometry	Music	French or Latin	Science	Freehand Drawing or Geometry	Instrumental Music	French or Latin	Science	Freehand Drawing or Geometry	Music	French or Latin	Science	Freehand Drawing or Geometry	Instrumental Music
	2																
	3																

8. Draw a map of the Northern coast of the Mediterranean, marking in promontories, islands, regions of volcanic activity, and character of shore.

9. Write down the principal facts respecting Asiatic River Systems.

10. What are cyclones, monsoons, typhoons, and the Harmattan? Explain how a barometer is useful in predicting storms.

11. Deduce the descent of James I. from Henry VII. Who was Lady Arabella Stuart?

12. What were the objects and results of 'The Hampton Court Conference'?

13. Write out Euclid I., 42.

Construct a parallelogram which shall be equal in area and perimeter to a given triangle.

How would you utilise old stockings, old sheets, and old table-cloths?

14. What construction is used in Latin after verbs of threatening? Explain the term *ablative absolute*, and the construction of the following italicised words :—

(*a*) '*Parcere* victis est *victoris*.'
(*b*) 'Sit *mulieri servitum*.'

Give the plurals of *neveu, chou-fleur*; the singular of *les yeux, les travaux*; the feminine singular of *roux*, the masculine singular of *nulle*, and the feminine plural of *quelqu'un*.

15. What method would you adopt in *commencing* to teach History to Standard III?

Explain the use of cubes, dominoes, and the ball-frame in teaching number.

16. How does the arrangement of the minor scale intervals differ from that of the major scale?

17. (*a*) $\frac{2x-5}{3x-7} = \frac{2x-7}{3x-5}$ Ans. $\frac{12}{5}$.

(*b*) Find the fraction which becomes $\frac{1}{2}$ when two is taken from its denominator, and $\frac{1}{3}$ when 2 is added to its numerator.

Ans. $\frac{6}{10}$.

What are the requirements for Standard III. needlework?

18. The sides of a triangular field are respectively 11, 13, 20 chains. Find (*a*) the acreage of the field, and (*b*) the perpendicular distance of the longest side from the opposite corner.

Ans. 6·6 acres, 6·6 chains.

CONVERSATIONAL LESSONS IN CHEMISTRY.

BY THOMAS CARTWRIGHT, B.A., B.SC.(LOND.).

First Class Honoursman in Chemistry, S. and A. Department, Lecturer in Chemistry to the Middlesex County Council, and in Physiography to the Birkbeck Institution, Chancery Lane, E.C.

FOR full particulars of the PRACTICAL TEACHER set of chemical apparatus and list of chemicals to be used therewith, together with address of the firm which supplies them, *see* our issues for January and February, 1893.

LESSON V.

When we analysed water, *i.e.* split it up into its component elements, what names did we give to these elements? Oxygen and Hydrogen. Quite so; and we now proceed to discuss the latter of these two gases. First of all, consider the word itself, What does 'gen' mean? You have told me that it means 'I make,' from the Greek word 'genao,' and you also said that it occurred somewhat frequently in chemical names, as oxy*gen*, hydro*gen*, nitro*gen*, &c., and was therefore important. Yes, I see you have recollected that nicely. Now, what does 'hydro' mean? It means 'water,' from the Greek 'hudor' or 'hydor' as we spell it. Very true, and next give the signification of the whole word? The water-maker. In what other bodies do we always find H? In acids. How then shall we prepare H? By the electric analysis of water in the first place. Well, remember what we did with the sodium and the potassium. What gas did we get then? Hydrogen; and I now see that another method of preparation is by the action of some metals on water. Yes, you have been wise in saying *some* metals, as metals vary greatly in their affinity for water. Sodium and potassium, as you will see from a second performance of the experiment referred to in Lesson II., readily decompose water at ordinary temperatures. Does iron decompose water? No. Well, it does so only when the iron is finely divided, as filings, and when the water is at a high temperature. The apparatus which is figured on the board will explain this,

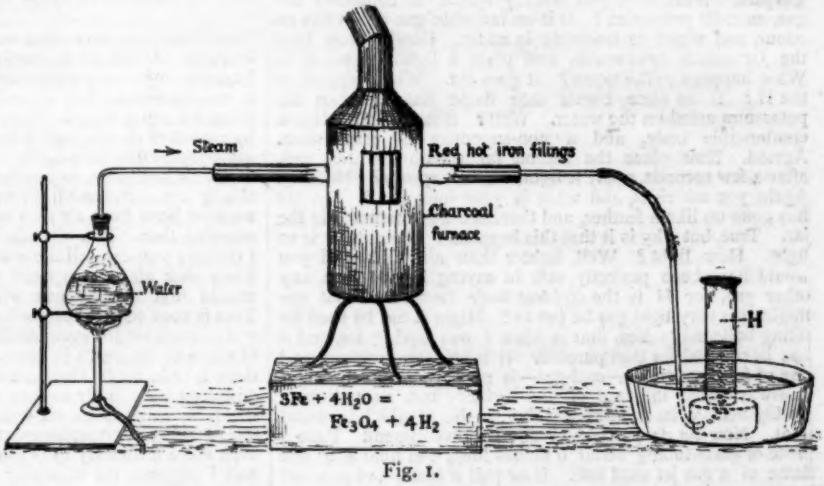


Fig. 1.

and you must remember that when steam is passed over red-hot iron filings the water (steam) is decomposed into H, which is set free, and O, which combines with the iron to form what? Oxide of iron. We will now see what can be done with acids. Prepare two flasks, as in the figure, with

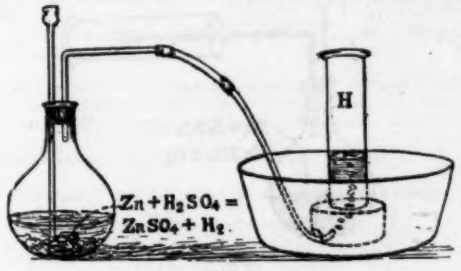


Fig. 2.

thistle funnel and leading tube, and get ready to collect your gas by downward displacement of water as in Lesson II., except that the Bunsen burner will not be required. Why? Because the gas comes off at ordinary temperatures. Why? Because there is great chemical attraction or affinity between the acid and the metal. In the first flask place some zinc, in the second some magnesium, and on each pour some H_2SO_4 or HCl. What do those bubbles indicate? The evolution of a gas. Yes. Collect four or five jars of the gas. Now, before experimenting with these jars of H, let me ask you to remember that you must try to obtain an insight into the nature of the gas from the experiments which are performed, otherwise you will be wasting your time. Also, before experimenting, let us distinctly understand how we have obtained the element H. Of course, we can't make it. Why? Because it is a simple substance, or an element. We shall

obtain it then from its compounds as easily and as cheaply as possible. What is its cheapest compound? Water. Can we get it from water? Yes, by the action of sodium (Na) or potassium (K), as well as by electric analysis (electrolysis as you called it). Exactly so, but Na, K, and current generation, are expensive, so that we shall not proceed in that way. Well, what is the cheapest metal? Iron. Why not prepare H from water by the agency of iron? Because the apparatus is too costly. Quite true, and so let us turn to the acids. What is the commonest? H_2SO_4. What metal did we employ to decompose this acid? Magnesium (Mg). Yes, but that is too dear. And zinc? Well, zinc is plentiful and cheap, hence the commonest way to prepare H is by the re-action of Zn and H_2SO_4. You will then please remember that the general ways of preparing H are by (1) the action of *metals* on *water*, and (2) the action of *metals* on *acids*. Now to our gas jars. What have you already learnt, in collecting the gas, as to its properties? It is an invisible gas which has no odour, and which is insoluble in water. Good. Now hold the jar mouth downwards, and place a lighted taper in it. What happens to the taper? It goes out. What happens to the H? It at once bursts into flame just as when the potassium acted on the water. Well? Showing that H is a combustible body, and a non-supporter of combustion. Agreed. Now place the second jar mouth upwards, and, after a few seconds, apply a light. What occurs? Nothing. Again you are right, and what is your inference? The gas has gone up like a feather, and therefore none remains in the jar. True, but why is it that this happens? Because H is so light. How light? Well, lighter than air. Yes, and you would have been perfectly safe in saying lighter than any other gas, for H is the *lightest body known*. What use might this very light gas be put to? Might it not be used for filling balloons? Yes, that is what I was asking for, and it has been used for that purpose. It is so dear, however, and one of its compounds—coal-gas—is so cheap, that the latter is always used in place of the former; but, as you may readily believe, its suitability is due to the H which is found in it. Now let us proceed to another experiment. Take a piece of glass tubing about 6 inches long, and hold it in the flame of a gas jet until soft. Now pull it apart, and you will have two glass gas jets. File off the sharp end of one, and thus make an opening fairly large. Now fasten the jet on the ⌐ piece of your delivery tube as in the diagram which I have figured on the board. Catch

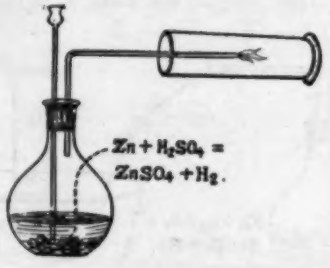


Fig. 3.

a sample of the gas in a test tube, *and see if it burn quietly* without explosion. If so, then ignite the H jet, and place over it a *dry* gas jar or beaker. What do you observe on the sides of the jar? A film of moisture. Quite true, and if you continue sufficiently long, and keep the jar cool, you can collect enough liquid for you to prove conclusively that it is water. Please state clearly what this experiment teaches. That when H burns in air it forms water. Yes, $H_2 + O = H_2O$; so that the burning here is simply oxidization, just as it is in our own bodies. Now, observe, the flame is not very brilliant, is it? No. If you place a metal, or other substance, in it, you will find that, although practically *non-luminous*, it is a *very hot* flame. Indirectly, also, this non-luminous flame is concerned with the production of that most brilliant illumination—the lime-light—which is used so effectually with the magic-lantern, etc. A mixture of O and H in the proper proportion is passed through a jet and ignited. The flame which results is the hottest of all flames, and as it is made to fall on a cylinder of lime it raises this to incandescence, *i.e.*, it makes it white-hot, and the small cylinder gives out the dazzling lime-light. The figure on the board will explain this.

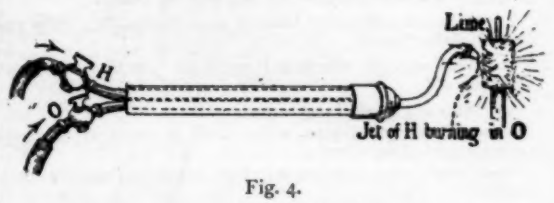


Fig. 4.

Now, briefly go over what we have learnt about H. It is an invisible gas which is insoluble in water, inodorous, combustible, and a non-supporter of combustion. It burns with a non-luminous, but exceedingly hot flame, and water is formed when it burns. It is obtained from water and acids by means of metals, and it is used to fill balloons, and for the oxy-hydrogen or lime-light.

Let us now turn to another common substance which is closely connected with our well being. Besides fresh water, we must have fresh air; we will therefore now turn to air, and examine that. You already know that air is a mixture, and I daresay you can tell me some of its constituents. Oh yes I know that air is composed of oxygen and nitrogen; but I should first like to ask why it is called the atmosphere. That is soon settled: 'atmos'=vapour, and 'sphere' you know, and you can readily imagine that the air forms a hollow sphere of gas with the earth in its centre. How can you prove that there is O in air? Does not the burning show it? Well, but do things burn in air as they do in O. Certainly they do, and the same compounds are formed, as was proved by the burning of sulphur, phosphorus, etc. Exactly so; but did not S burn more brilliantly in O than in air. Without doubt it did, and I suppose the dimming was the work of the nitrogen. Perfectly correct, and well thought out. Now, can you think of any plan to obtain O from air, so that we can test it? I think so; did you not say that Dr. Priestley obtained O from air, by heating mercury in it for some time, and then raising the oxide which was thus formed to a higher temperature? Right, and as the experiment is long and tedious we will take Dr. Priestley's word for it, and not attempt to follow out the experiment. Let us now try to separate the N from the O.

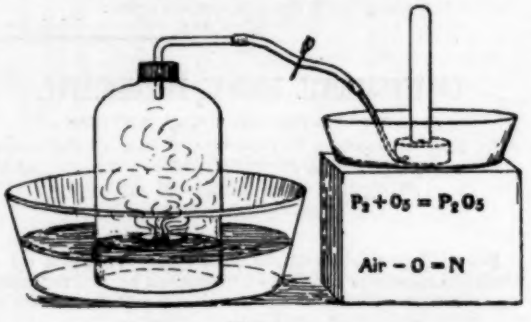


Fig. 5.

Cut off a small portion of phosphorus under water, and float it on a capsule on the surface of some water in a pneumatic trough. Ignite the P and place a little jar provided with a leading tube over the ignited phosphorus. Now what are those white fumes? Phosphorous oxide. Yes, they are phosphorous pentoxide (P_2O_5). Now, have we got our N? No, I think we are as far off as ever, for now we have a mixture of P_2O_5 and N and we began with a mixture of O and N. Think a moment, and then say what quality the P_2O_5 should have if we are to get N alone from the mixture? If it had the

property of vanishing, the N would be left, but magic won't help me. I'm—Ah, now I have it, the P_2O_5 is soluble in water and is already beginning to disappear. Just so, and now keep your eye on the jar and see what happens. What has the P taken away with it? The O. What then should the water do if the O has gone? It should rise up and fill the space formerly occupied by the O. Continue. I have nothing further to say. Don't be too hasty. Wait until the fumes of P_2O_5 are quite gone, and then tell me how far the water has crept up the jar. It has gone up about one-fifth of the space which the air filled at first. Quite true, and can't you see that one-fifth of the air is thus shown to be O. Oh yes, I see it now, and of course four-fifths will be N. Yes, a good way to remember this is to write down air as 4N+O. Before proceeding further let us examine the N. Fill up the trough with water and let the bell-jar float up. Can you see how to let some of the N out of the bell-jar now? I think so, may I try? Most decidedly, that is just what I want you to do, but first describe your plan of action, so that no mistake may be made. I shall place the small gas-jar full of water over the beehive shelf in the small pneumatic trough, and pinch the stop-clip: the gas will rush out, and will be collected by downward displacement of water, *i.e.*, if it is not soluble in water. Your method is perfectly correct, so now set to work and apply the usual tests, and then give me a description, as full as possible, of N. Nitrogen is an invisible, tasteless, inodorous gas, it is incombustible and a non-supporter of combustion. Good, now I will finish: it will not support life, and seems indeed incapable of doing anything. For this reason it is spoken of as a negative body. Indeed the French name for it—'azote' ('a'=not 'zoe'=life)—clearly indicates this. Which is the more important constituent of the atmosphere then? Oxygen, without doubt, as it is the supporter of life. Quite so, all living beings, both plants and animals, wherever found, on land or in the sea, must have O to breathe. But come, now, what can you say respecting the N. All I can say, is that it does no harm and also that it does no good. Not a very nice way of putting it, but still not far out. The function of the N is to lessen the activity of the O and so prevent our bodies from consuming too rapidly as they would do if we breathed undiluted O. Now is there anything else which is always found in air besides O and N? What do you often see on the grass in the morning? Dew. What is dew? Water. Exactly so, and it has come from the air, so that water vapour is always present in air, and if the amount falls below 1½ per cent., our skin feels very uncomfortable, so that this moisture is necessary to our comfort. Now for the suffocater which is always present in all air, no matter how pure it may be. What! is there always a suffocating substance in air? Yes, undoubtedly so. Have you ever read of an explosion in a coal mine, and of the brave fellows who have gone down the mine to save life and who have sometimes been suffocated themselves? Alas, yes. The body which brings about this disastrous result, is carbon dioxide (CO_2), and it is ever present in air. It must be present in very small quantities then, must it not, Sir? I will give you the figures, then you can judge for yourselves: ·04 per cent. or 4 parts in 10,000 parts. You might as well call that nothing for all the good or harm that it may do. Now get ready for another paradox. If all the CO_2 were to be taken out of the air, there could be no living being on the earth! What is the chief element in plants and in animals. Is it not carbon? You are right, and the carbon, which forms the greater part of the tissues of the plants, comes from this very CO_2 of the air. As to how, I can only tell you that the green parts of plants—aided by sunlight—decompose the CO_2 of the air and take the C for themselves and soon convert it into starch, setting free the O, which of course helps to purify the air. In addition to the three substances mentioned, there are two other bodies found in air, viz., ozone and dust particles. Ozone is really O in a very active form. It is only found in places remote from towns, and it is this which makes the air of country and seaside places so very beneficial. The dust particles are unfortunately wholly injurious. Some of them are germs which when breathed may cause the dreaded diseases which visit us from time to time; furthermore the dismal fogs are always more frequent and also more dense in places where the air is heavily charged with dust particles. Can you tell me now of the 146 men who entered the Black Hole of Calcutta, why only 23 came out alive? Yes, they were suffocated by CO_2. Where did the CO_2 come from? From their breath. But how is that? If, as you have just said, our bodies consist of carbon, and if this combine with O then CO_2 must form; as that body suffocates those who breathe it, the death of those poor fellows is accounted for. What is the lesson to be learnt? Do you mean the necessity for ventilation? Yes. We will now bring our long lesson to a close by putting the composition of air in tabular form for memorising.

Composition of air.

Body.	Where found.	Effects.
Oxygen 21 per cent.	In all samples	Supports life.
Nitrogen 79 ,,	,, ,,	Dilutes O and renders it less active.
Water 1½ ,,	,, ,,	Keeps skin moist.
Carbon Dioxide ·04 per cent.	,, ,,	Provides food for plants.
Ozone - -	Country & Seaside	Invigorates.
Dust particles -	Mostly near towns	Cause fog and diseases.

(*To be continued.*)

THE 1893 SCHOLARSHIP EXAMINATION.

BY DR. GEORGE BEACH, M.A.

Co-Author of 'A Manual of our Mother Tongue,' 'A Girls' Arithmetic.' Author of 'Elements of English,' 'Entertaining Readers,' etc.

1. If any intending Candidate has not hitherto notified to the Department his purpose of sitting at the Scholarship Examination on Wednesday, 5th July 1893, he should at once do so.

On the receipt of this issue he will just have sufficient time and none to spare.

Care must also be taken to secure the marks for Reading, Recitation, and Teaching.

2. In our last Number we inserted an important communication from the Science and Art Department which re-instated 'Model Drawing' as a mark-earning subject for the Scholarship Examination.

The New Code endorses this correction in its 'Schedule V.'

3. ANALYSIS OF QUESTIONS DURING LAST TWELVE YEARS :—

(*a*) *Domestic Economy* has been already given.

(*b*) *English* ,, ,, ,,

(*c*) *Geography* ,, ,, ,,

(*d*) *History* (the favourite questions are in *italics*) :—

α *Dates* of Deaths of *Mary Queen of Scots*, Canute, Henry VII., *Nelson*, *Wallace*, Wolfe, Montfort, Charles I., Pitt, Becket.

β *Dates* of *Crecy*, *Flodden*, *Boyne*, Culloden, *La Hogue*, Standard, Poitiers, Stamford Bridge, *Hastings*, Plassy, Spanish Armada, *Blenheim*, Newbury, Bosworth, Dettingen, *Pinkie*, Inkerman, *Evesham*, *Waterloo*, Dunbar, Aylesford, Barnet, Corunna, Vinegar Hill, Lexington.

γ *Dates* of Peace of Amiens, Ryswick, Paris.

δ *Dates* of *Abolition of Slave Trade*, *Slave Emancipation*.

ε *Dates* of *Signing of Magna Carta*, Septennial Act, *Habeas Corpus*, Reform Bills, *Petition of Right*, *Declaration of Right*, *Legislative Union of Great Britain and Ireland*, of England and Scotland.

ζ *Dates* of Accession of George I., Edward I., James I., Stephen, Anne, Elizabeth, Harold, James II., William II., Kings at beginning of 10th to 19th centuries.

η *Dates* of Acts of Uniformity, *Catholic Emancipation*, Five Mile Act, Dissolution of Monasteries, *Præmunire*, Act of Supremacy, Acts against Dissenters and Romanists, Declaration of Indulgence, *Solemn League and Covenant.*

θ *Dates* of *South Sea Bubble*, Darien Scheme, Abolition of Corn Laws, Navigation Acts, Statute of Labourers, Establishment of Bank of England, and National Debt.

ι Who were the Lollards, Roundheads, Regicides, *Pilgrim Fathers*, Cabal, Luddites?

κ Explain the Making of a New Law, Proceedings on a Criminal Trial, *Impeachment*, Attainder.

λ Explain the terms Spiritual Peer, *Alderman*, Viceroy, Minister of State, *Knight of the Shire*, Premier, Lord Chancellor, Chief Justice, Admiral, Field Marshal, *Regent*, Governor-General.

μ Narrate the events during governorship of *Suetonius Paulinus*, Agricola, Saxon Settlement, *Danish Invasions*, reigns of Henry III., Edward III., *Henry VIII.*, Henry V., Henry VII., Elizabeth, *Charles II.*, Victoria, latter half of 18th century.

ν What do you know of Norman influence in England before the Conquest, *Feudal System*, Feudal Relations between England and Scotland, *Poyning's Law*, *Reformation*, The Universities, Parliament of Henry VIII. *versus* that of Charles II., *Star Chamber*, Court of High Commission, *Ship Money*, Quarrels between Church and Crown, Consequences of Battles of Nile and Quebec, Seven Years' War, War of American Independence, Extent of Dominions under Egbert, Alfred, Canute, William I., Henry III., Edward III., and Henry V., Relations between England and Spain under the Tudors and Stuarts, *Foreign Policy of Cromwell* versus that of Charles II., *Foreign Policy of William III.*?

ξ What events are connected with Tower of London, Holyrood House, Stirling, Derby, Worcester, Shrewsbury, Plymouth, Canterbury, Lincoln?

ο *Civil Wars*, *Plots*, *Revolution of* 1688.

π Condition of people, trade, communication in 17th century, 19th century, *under Tudors*. Trace the growth of the Poor Law.

ρ Sketch the characters of Alfred, Henry III., Edward III., *Henry VIII.*, William III., Henry V., *Charles II.*, Henry II., Edward I.

σ Write lives of Maid of Norway, Margaret of Anjou, Anselm, Langton, Sir C. Napier, Clarendon, *Raleigh*, Sir P. Sydney, Drake, Burleigh, Cecil, *Hampden*, Falkland, T. Cromwell, Marlborough, Hubert de Burgh, Burnet, *Duke of Wellington*, Dunstan, Bede, Bolingbroke, John Wilkes, Burke, *Becket*, John of Gaunt, *Pitt*, *Nelson*, Hereward, Wilberforce, Cobden, John Howard, Palmerston, and Fairfax.

τ Under what circumstances were Cape Colony, Ceylon, Jamaica, *Channel Isles*, Bombay, Hong Kong, *East India Company's Possessions*, Pennsylvania, Zanzibar, added to our Empire?

υ What do you know of *Invention of Printing*, *Revival of Learning*, Translations of Bible into English?

φ Comment on certain historical quotations from *Shakespeare*, Scott, *Macaulay*, Aytoun, and Campbell.

χ Mention the chief works of *Milton*, *Shakespeare*, Chaucer, Macaulay, Dryden, Scott, Hume, Sir Philip Sydney, Carlyle, Herbert, Locke, *Newton*, *Pope*, Reynolds.

ψ Trace the descent and claim to the throne of Houses of Tudor, *Stuart*, Orange, and *Brunswick*, and of Stephen.

What relation was Mary I. to Philip, and Mary Queen of Scots to Darnley?

Trace Edward III.'s and *Henry V.'s claims to the throne of France.*

ω Enumerate the various Queen Consorts, Prince Consorts, *Minor Kings and Regents.*

(*c*) SCHOOL-MANAGEMENT (*the favorite questions are in italics*):—

α *Notes of Lessons* on *Simple Subtraction*, Short Division, *Multiplication of Vulgar Fractions*, *Method of Unity*, and Simple Interest.

β *Notes of Lessons* on *Simple Analysis*, Complex Sentences, Adverbial Phrases, Transitive and Intransitive Verbs, Moods of Verbs, *Adverb*, Preposition, Conjunction.

γ *Notes of Lessons* on Cape, *Seasons*, Ocean, Mountains, Rivers, the Mississippi.

δ *Notes of Lessons* on Passing of an Act of Parliament, some King of England, *Cardinal Wolsey*, Joan of Arc.

ε *Notes of Lessons* on Silver, Steel, *Iron*, Leather, Glass, *Sugar*, Fruits, Corn, Forests, a Railway, Blacksmith's Forge, Coal-mine, Parts of a House, Flour Mill, Post Office, Manufacture of *Cup*, Needle, Boot.

ζ *Notes of Lessons on* The Whale, Animals of the *Cat* Kind.

η *Notes of Lessons* on *Primary Colours*, *Square*, Fire.

In many of the above questions, details of the apparatus, models, and diagrams are required.

θ *Lists of Lessons* on common things illustrative of atmospheric pressure, twenty lessons on *familiar animals*, on phenomena of daily life.

ι *Blackboard Sketches* of the above to be used both for teaching and recapitulation.

κ *Object Lessons uses of*, definition of, scheme of.

λ *Home Lessons uses of*, objections against, *weekly scheme of.*

μ *Reading.* Advantages and disadvantages of Alphabetical Method, and of 'Look and say' Method, *word building*, Difficulties encountered during and apparatus required for teaching Infants, *Commonest faults in Reading*, *Use of simultaneous and pattern Reading*, *Rules for imparting expression, distinctness, and style*, Rules for promoting articulation and intelligent rendering, How to test the intelligent understanding of given passages, *How to explain difficult given passages.* Explanation of figurative language. Arrangement of class for Reading. Meaning of such words as 'linked,' 'serried,' 'groom,' 'squire,' 'knight,' 'declines,' 'nature,' 'languor,' 'insects,' 'flutter,' 'saunter,' 'pastures.'

ν *Writing.*—Mulhauser's system; systems of ruling slates and copy-books; *groups of letters; explain length of letters* in such words as 'trustfulness,' 'geographical analysis'; course of writing for an Infant School; *use and abuse of tracing;* engraved versus blackboard copies; height, position, and arrangement of desks.

ξ *Arithmetic.*—Use of ball-frame to teach Short Division; *use of diagrams and models* to teach fractional operations and notation; *the two methods of subtraction;* the advantages of Compound Practice over Multiplication of Money; the rule (and its reason) for converting pure Decimal Repeaters to Vulgar Fractions; *Simple Proportion versus Method of Unity;* how to teach Simple Multiplication, Division by Factors, Ascending Reduction, Subtraction of Fractions, Multiplication of whole numbers by Fractions; *the use and reason of cancelling.*

ο *Grammar.*—How to give a Lesson on an Adjective; *How to distinguish between same words as different parts of speech;* Rules for concord of verb with more than one subject connected by disjunctive conjunction; *How to determine Case; Explanaion of grammatical difficulties in given passages;* How to teach Analysis; *Definition (with examples) of a sentence, a simple, a complex, and a compound sentence.*

π *Composition.*—How to commence composition in Standard III.; *How to correct composition;* How to write and correct a letter.

ρ *Geography.—Requisite geographical apparatus;* Use of globe, mariner's compass, sundial, and thermometer; *Differences between Pictures, Plans, and Maps; Draw up and describe the use of an outline plan of Parish or District;* How to teach scale and proportion in maps; Use of lines of Latitude and Longitude; Effect of mountain ranges on climate; *How to give a lesson on Rivers;* What facts should be selected whereby to compare countries?

σ *History.*—Use of Chronological Tables, and at what point of instruction should they be introduced? *Use of* Ballad Poetry and *Biography* in teaching History; *Description of such battles as Flodden and Waterloo.*

τ *Spelling.—Common faults in teaching spelling; Imperfections of English orthography;* Oral versus written teaching of spelling; Spelling of passages previous to Dictation; Advisability of oral spelling in midst of Reading Lesson; *Selection of difficult words from given passages;* Typical difficult words for the various standards; *Dictation versus Transcription for Standard I.; Rules for a Dictation Lesson.*

υ *Repetition.—Commonest faults; suitable poems for various classes.*

φ *Drawing.*—Scheme of earliest lessons in Infant School.

χ *Music.—How to teach a new song; First steps of teaching to sing by note;* How to correct faults in pitch.

ψ *Needlework.—How to utilise apparatus in class teaching;* How to teach Darning simultaneously; Teaching of Plain Sewing by demonstration method; *Use of different coloured cottons; Measurement of garments.*

ω *Kindergarten, etc.—Froebel's seven gifts;* Explanation of Kindergarten terms; *How do Kindergarten occupations serve to stimulate invention, imitation, intelligence, observation, and obedience; and assist in training the eye and hand?* How should 'the gifts' be used? *The best appropriate occupations and their educational purpose;* Geometrical properties taught by paper-folding. What manual exercises assist writing? Rules for Drill and Exercises in School and Playground; *purpose of lessons on Form and Colour;* Order in which plane figures should be taught.

α 2 *Mental Arithmetic.—How to make M. A. interesting; objects served by M. A.;* Specimen examples of concrete and fractional operations upon number '30'; *Typical series of examples upon various rules and for divers standards.*

β 2 *Punishment, Discipline, Formation of Habits, etc.—Why young teachers should not inflict corporal punishment;* Substitutes for Corporal Punishment. *What is good Discipline and how to maintain it?* Expedients for arousing a lethargic and controlling a disorderly class; Discipline during a Criticism Lesson; *Area of school influence upon the production of Good Habits;* Lessons from the characters (enforced by anecdotes) of Duke of Wellington, Lady Jane Grey, Robert Bruce, and Nelson; *How teaching is facilitated by study of character.*

γ 2 *Teaching in General.—Individual* versus *collective teaching;* Use of and subjects suited for Gallery Lessons; *Utilitarian* versus *ethical value of the various subjects;* Sight not necessarily knowledge; *Subjects to be learned by heart;* English *versus* Geography as a Class Subject; Value of Criticism Lessons; *Use of Reading Books to teach History and Geography;* Blackboard as an aid to recapitulation; Preservation of Notes of Lessons; Use of a Teacher's Diary; *Best methods of examination;* List of books suitable, and slightly too difficult, for 13 year olds; How to organise an Infant School and classify new scholars; *School Penny Banks;* Formation, classification, and utility of school Museums and Libraries; Specimen of a school routine with time per week per subject; *Code requirements for ordinary, class, and specific subjects.*

δ 2 *Premises, etc.*—Plan of Schoolroom; *Daily, weekly, periodical cleanings;* Rules for keeping S. R. healthy and clean; *Principles of Ventilation; Why are headaches and faintness caused by impure air?* Principles of heating, Situation of Thermometer, Schoolroom decoration.

N.B.—Don't forget Mr. Flux on 'Scholarship School-Management' in the 'INFANTS' MISTRESS.'

4. We have now made special provision so that Candidates may, for the sum of Half-a-Guinea paid in advance, get the answers to our weekly series of questions thoroughly marked and criticised.

Fortnightly series may be taken for 5s. 6d., a single week for 1s. 6d.

These arrangements will continue until the Scholarship Examination; after which date every effort will be made so to organise the 1894 Classes and Articles that the gratifying successes of the past may not only be continued but surpassed. (*See* paragraph 7.)

5. For list of the Science and Art Examinations, together with dates and times, see p. 548 of our last issue. To all our Readers interested in these tests we heartily wish 'First Classes.'

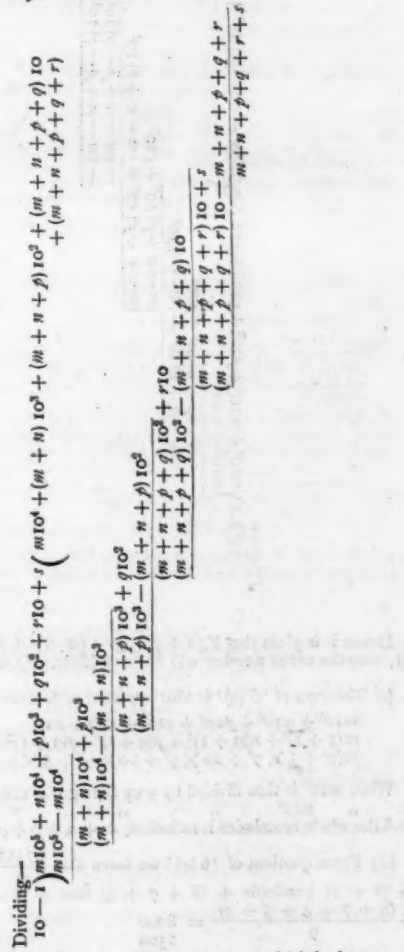
6. MATHEMATICAL WRINKLES:—

(*a*) *Any number will divide by* 9, *when the sum of its component digits will divide by* 9.

Proof.—Any number of the ordinary scale may be represented on the following system:—

$$m10^5 + n10^4 + p10^3 + q10^2 + r10 + s$$

Also $9 = 10 - 1$



Hence it is plain that if $m + n + p + q + r + s$, which is the sum of the digits, is divisible by 9, then the entire number will be so divisible.—Q. E. D.

(*b*) *Any number will divide by* 11, *when the difference between the sums of the alternate component digits is divisible by* 11. Thus

8172637 is divisible by 11 because $(8+7+6+7)-(1+2+3)=2\times 11$.

Proof—

$$\begin{array}{r|l}
10+1 & m10^5+n10^4+p10^3+q10^2+r10+s \\
 & m10^5+m10^4 \\
\hline
 & (n-m)10^4+p10^3+q10^2+r10+s \\
 & (n-m)10^4+(n-m)10^3 \\
\hline
 & (p-n+m)10^3+q10^2+r10+s \\
 & (p-n+m)10^3+(p-n+m)10^2 \\
\hline
 & (q-p+n-m)10^2+r10+s \\
 & (q-p+n-m)10^2+(q-p+n-m)10 \\
\hline
 & (r-q+p-n+m)10+s \\
 & (r-q+p-n+m)10+(r-q+p-n+m) \\
\hline
 & s-r+q-p+n-m
\end{array}$$

Hence it is plain that if $(n+q+s)-(m+p+r)$ is divisible by 11, then the entire number will be so divisible.—Q. E. D.

(*c*) Theorem of '6 (*a*)' is also apparent as follows:

$$m10^5+n10^4+p10^3+q10^2+r10+s=$$
$$m(9+1)^5+n(9+1)^4+p(9+1)^3+q(9+1)^2+r(9+1)+s=$$
$$m(9^5+5\times 9^4+10\times 9^3+10\times 9^2+5\times 9+1),\text{ etc.}$$

When $m10^5$ is thus divided by 9 we thus get m remainder.
" $n10^4$ " " " n " "
and the whole remainder is as before, $m+n+p+q+r+s$, etc.

(*d*) From quotient of '6 (*a*)' we learn that $\frac{87453}{9}$ = 8 thousands + (8 + 7) hundreds + (8 + 7 + 4) tens + (8 + 7 + 4 + 5) + $\frac{(8+7+4+5+3)}{9}$ = 8000 + 1500 + 190 + 24 + 3 = 9717

(*e*) If A and B are roots of $x^2+px+q=0$, express $\frac{A^2}{B}+\frac{B^2}{A}$ in terms of p and q.

Proof.—

$$\frac{A^3}{B}+\frac{B^3}{A}=\frac{A^4+B^4}{AB}=\frac{(A+B)\,(A^3-AB+B^3)}{AB};$$

but (A + B) being the sum of the roots $= -p$
and AB being the product of the roots $= q$

$$\therefore \text{ substituting } \frac{A^3}{B}+\frac{B^3}{A}=\frac{-p(A^3+2AB+B^2-3q)}{q}$$
$$=\frac{-p\{(A+B)^2-3q\}}{q}$$
$$=\frac{-p(p^2-3q)}{q}$$

(*f*) It must be remembered that similar triangles are to one another in the *duplicate* ratio of their homologous sides. Thus if the sides are as 8 : 12 = As 2 : 3, the areas are as 4 : 9. In the diagram to '(*f*)' *supra*, triangle PSL = $\frac{4}{9}$ of triangle NSM.

When the areas are given, the homologous sides are to one another as the *square roots* of the areas.

This property is taken advantage of in such 'Catch Questions' as the following:—

Find the side of a regular nonagon whose area shall be equal to that of an isosceles triangle with base angles of 70° and base 30 feet long.

Now it will be seen that (1) a nonagon can be divided into 9 isosceles triangles whose vertical angles will each be 40° and whose base angles will each be 70°.

Each of these triangles is therefore similar to the given triangle, but of only $\frac{1}{9}$ area.

Their bases will therefore be only $\sqrt{\frac{1}{9}}$ $(=\frac{1}{3})$ of 30 feet, viz. 10 feet.
Similar questions can be propounded respecting all the regular polygons.

(*g*) *Out of a chess board divided into 64 squares of a square inch each, the 64 inscribed circles are cut. What area of wood remains?*

A little reflection will show that the remainder is exactly the same as when one circle of 8 inches diameter has been inscribed within the square of the board itself.

(*h*) *Find diagonal of square which shall be equal in area to a rectangle 25 feet by 18 feet.*

It is plain that this *diagonal* will be the *side* of a square *double* the required area, and that therefore the answer will be $\sqrt{2\times 25\times 18}=\sqrt{2\times 2\times 5\times 5\times 3\times 3}=2\times 5\times 3=30$ feet.

(*i*) It is useful to remember that an equilateral triangle circumscribed about a circle is four times the area of the inscribed triangle; that a circumscribed square is double the area of the inscribed square; and that a circumscribed hexagon is four-thirds of the inscribed hexagon.

7. We have now made arrangements with distinguished graduates and experienced practical teachers to 'coach' for the Scholarship Examination at the following *inclusive* rates, paid in advance:—£3 per annum, 15s. 9d. per quarter, or 1s. 6d. per single paper.

There will be no extra charge for Latin, French, or drawing.

To the first 20 applicants, the 'PRACTICAL TEACHER' will be forwarded gratis each month, and we hope to be able to arrange a liberal prize scheme in connection with the 1894 Class. Application should be made at once.

Whilst not wishing to interfere with any existing arrangements, we would earnestly urge *all* our readers to secure sufficient examination-practice before sitting.

For Correspondence see end of Certificate Article.

We are informed by Messrs. Isaac Pitman & Sons, that at the recent Cambridge Local Examinations, open to England and the Colonies, the three students who were bracketed first amongst those who passed with distinction in Shorthand, were all writers of Pitman's system.

Week Ending 6th May 1893.

1. In how many ways can you classify Adverbs? Classify them according to their origin.

2. Give two instances of Prepositions governing Noun Sentences. Write four sentences showing that Prepositions may sometimes follow the governed word.

3. Enumerate the Southern States of America, giving the two principal towns of each.

4. What do we obtain from Ballarat, Kapunda, Dunedin, Suva, and New Guinea?

Of what use to us are the Auckland Islands, Cyprus, Guernsey, and the Bahamas?

5. State the relations between France and England in the reign of Henry I.

6. Trace briefly the decline of the Feudal System and the rise of the Standing Army.

7. What scholars are liable to over-pressure? Give instances shewing that thorough 'freedom of classification' now exists in elementary schools.

8. State briefly the educational value of each of the subjects taught in your school.

9. Show the ordinary compass of boys' (or girls') voices in the ordinary scale.

10. Divide £7,689 18s. 11¾d. by 357, explaining each step.
Ans. £21 10s. 9¼d. + 305q. rem.

11. I invest £7,560 in the 3 per cents. at 94⅜, and when the funds fall to 90¾ I sell out a quarter of my stock; afterwards when the funds are at 94⅞, the remainder of the stock is sold. What, reckoning brokerage, is the alteration in my capital?
Ans. £75 less.

12. (*Men only.*) Write out Euclid I. 35.

In the base of a triangle, find the point from which lines drawn parallel to the sides of the triangle and limited by them are equal.

(*Women only.*) What instruction have you received in cooking? Describe the advantage of such instruction for the comfort and health of a School Teacher.

13. (*Men only.*) Write out Euclid I. 13.

Shew that the square on the hypothenuse of a right-angled triangle is equal to four times the area of the triangle together with the square on the difference of the sides.

(*Women only.*) What precautions have you been instructed to take upon the breaking out of any infectious disease in your neighbourhood?

14. (*Men only.*) Find the length of the sides of a parellelogram, one angle being half a right angle, the altitude being equal to half the base, and the area containing 1,250 sq. feet.
Ans. 50 feet; 35·35 feet.

(*Women only.*) An army is besieging a town in which are 1000 men with provisions for 3 months, How many must leave at once so that the food may last a year? Ans. 750.

15. Solve:

$$\sqrt{\frac{a+x}{a-x}} + \sqrt{\frac{a-x}{a+x}} = \sqrt{5}. \qquad \text{Ans. } \pm a\sqrt{\tfrac{1}{2}}$$

16. A purse contains only threepenny and fourpenny pieces, equal in value to £2 10s. 7d. If the number of threepenny and fourpenny pieces were interchanged, the value would be £2 8s. 7d. Find the number of coins of each set. Ans. 73 threepences; 97 fourpences.

Week Ending 13th May 1893.

1. What Latin prefixes have Gallicised forms? What are the roots of *consequently, descent, dissent, decent, decentralise, century,* and *India.*

2. Analyse the following lines and parse the italicised words:—

'Now *stir* the fire and close the *shutters fast,*
Let *fall* the curtains, wheel the sofa round,
And, *while* the bubbling and *loud* hissing *urn*
Throws *up* a steaming column, and the cups
That cheer *but* not *inebriate wait* on *each,*
So let us welcome peaceful evening *in.*—*Cowper.*

3. Draw a map of the Northern and Western coasts of Australia.

4. Whence do we obtain cork, guano, saltpetre, potash, caoutchouc and camphor?

5. Give dates of the Bloody Statute, Wyatt's Insurrection, Execution of Mary Queen of Scots, Plantation of Ulster, Pride's Purge, and Great Fire of London.

6. Trace the descent of George III. from Henry VIII.

7. Describe the organisation of any good school with which you are acquainted.

8. Write Notes of a Lesson on the Latin Prefixes.

9. Write a perfect fifth above C, F♯, B, E♭, A. *Or,* above **d, fe, t, ra, l.**

10. Find the least sum of money that can be paid with an exact number of sixpences, half-pennies, or dollars (4s. 2d.).
Ans. 12s. 6d.

11. (*Men only.*) Find the square root of 1383·0961 and of $2\frac{23}{49}$.
Ans. 37·19 and $1\frac{4}{7}$.

(*Women only.*) If a train goes 45 miles per hour, how many revolutions does the driving-wheel, 22 feet in circumference, make in a second? Ans. 3.

12. (*Men only.*) Write out Euclid I. 37.

Describe a right-angled triangle of which the hypothenuse and the difference between the two sides are given.

(*Women only.*) Describe any simple remedies for a severe chill, a sick headache, a troublesome cough.

13. (*Men only.*) Write out Euclid II. 14.

In a right-angled triangle, the square on the greater side is equal to the rectangle contained by the sum and difference of the hypothenuse and the smaller side.

(*Women only.*) What instruction have you received in laundry work? Explain the benefit of such teaching.

14. (*Men only.*) The shorter diagonal of a rhombus is 1,014 feet; the length of a side is 845 feet. Find the area, and the length of the larger diagonal. Ans. 685,464 sq. ft.; 1,352 ft.

(*Women only.*) In what time will £56 5s. amount to £64 2s. 6d. at 3½ per cent. per annum simple interest? Ans. 4 years.

15. Reduce to lowest terms—

(*a*) $\dfrac{x+\frac{x^2}{3}+3}{x+\frac{9}{x}+3}$ Ans. $\dfrac{x}{3}$.

(*b*) $\dfrac{9x-35y-6x^{\frac{1}{2}}y^{\frac{1}{2}}}{9x+20y+27x^{\frac{1}{2}}y^{\frac{1}{2}}}$ Ans. $\dfrac{3x^{\frac{1}{2}}-7y^{\frac{1}{2}}}{3x^{\frac{1}{2}}+4y^{\frac{1}{2}}}$.

16. A and B exchange purses; A has as many half-sovereigns as B has half-crowns, and as many sixpences as B has shillings. Find the ratio of the number of half-sovereigns to the number of sixpences, that neither lose by the exchange. Ans. As 1 : 15.

Week Ending 20th May 1893.

1. State the derivation and meaning of each part of the following words: *philosopher, admiration, subjunctive, earthly, photograph, despatch,* and *pursue.*

2. Paraphrase—

'Life is the transmigration of a soul
Through various bodies, various states of being;
New manners, passions, new pursuits in each,
In nothing save in consciousness the same,
Infancy, adolescence, manhood, age,
Are always moving onward, always losing
Themselves in one another, lost at length,
Like undulations, on the strand of death.'
—*James Montgomery.*

3. What are the chief causes influencing climate?

4. Explain the reasons of the daily alternation of land and seabreezes at Jamaica.

5. Give an account of the disputes between Henry II. and the Pope.

6. What part did England take in the affairs of Greece in the reign of George IV.?

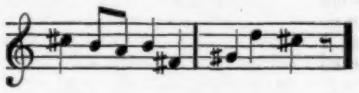
7. Who were the following, and when did they flourish? Hubert de Burgh, Wentworth, Earl of Bute, Sir Robert Peel, Cecil, Sir Robert Walpole?

8. What methods would you adopt to prevent copying, and to secure accuracy in a dictation exercise?

SCHOLARSHIP OR FOURTH YEAR ROUTINE FOR MAY 1893.

DAYS	FIRST WEEK			SECOND WEEK			THIRD WEEK			FOURTH WEEK		
	First Hour	Second Hour	Third Hour	First Hour	Second Hour	Third Hour	First Hour	Second Hour	Third Hour	First Hour	Second Hour	Third Hour
MONDAY	Brackets of Algebra (Theory and Practice) — Theoretical Needlework	History from 1547 to 1572	'De Bello Gallico,' *or* 'La Jeune Sibérienne'	Symbolical Expressions of Algebra — Ingredients of Food	Dates from 1461 to 1572	'De Bello Gallico,' *or* 'La Jeune Sibérienne'	Fractional Simple Equations — Rules of Health	History from 1603 to 1637	'De Bello Gallico,' *or* 'La Jeune Sibérienne'	Algebraic Factors — Miscellaneous Geography	Dates from 1572 to 1660	'De Bello Gallico,' *or* 'La Jeune Sibérienne'
TUESDAY	Euclid, Book I. — Diagram of Nightshirt	Political Geography of North America	Science *or* Revision	First Seven Propositions of Euclid, Book II. — Flannel Sampler	General Geography of Europe	Science *or* Revision	Definitions, Postulates, Axioms of Euclid, Book I. — Calico Sampler	Political Geography of New Zealand	Science *or* Revision	First Sixteen Propositions of Euclid, Book I. — Diagram of Nightshirt	Political Geography of remainder of Polynesia	Averages and Percentages
WEDNESDAY	Drawing *or* Revision	'De Bello Gallico,' *or* 'La Jeune Sibérienne'	How to Teach Geography	Compound Proportion	Paraphrasing and Repetition	Drawing *or* Revision	Discount	Paraphrasing and Repetition	How to Teach Mental Arithmetic	Theory of the Four Simple Rules	Parsing and Analysis	How to Teach Composition
THURSDAY	Simple Equations — Savings and Investments	History from 1572 to 1603	Study English from 'Grammar'	Problems in Simple Equations — Preparation of Food	Saxon England after the Heptarchy	Parsing and Analysis	Algebraic H.C.F. and L.C.P. — Clothing and Washing	History from 1637 to 1660	Table of English Literature	Problems in Simple Equations — Miscellaneous Geography	England under the Normans	English Accidence from Text Book
FRIDAY	Deductions upon Euclid, Book II. — Calico Sampler	Political Geography of South America	Theory of Practice and Proportion	Study any Notes on Euclid, Book I. — Diagram of Nightshirt	Map of Eastern States of America	Stocks	Euclid, Book II. — Flannel Sampler	Political Geography of Australia	English Composition	Algebraic Formulæ of Euclid, Book II. — Any Needlework	Maps of Victoria and New South Wales	The Metric System
SATURDAY	Drawing *or* Revision	Science *or* Revision	Examination	Latin *or* French Grammar	Science	Examination	Latin *or* French Grammar	Mixtures (Arithmetic)	Examination	Latin *or* French Grammar	Repetition, Literature, and Penmanship	Examination

9. In what scale or key is the following:



Write the following according to the 'better method':

Key C

| de' :t.l | t :fe | se :r' | de' :— ‖

10. A, B, and C rent a field for £85 10*s.*, A puts in 15 sheep for 4 months, B 24 for 5 months, and C 27 for 6 months. What share of the rent must each pay? Ans. £15, £30, £40 10s.

11. If a person transfer £1,234 from the 3½ per cents. at 88⅞ to the 3½ per cents. at 95⅜, what will be the difference in his income?
Ans. 4d. *nearly.*

12. (*Men only.*) Write out Euclid I. 39.
Having given one of the diagonals of a parallelogram, the sum of the two adjacent sides, and the angle between them, construct the parallelogram.

(*Women only.*) Describe the furniture, fittings, and materials which a parlour-maid would require for her pantry.

13. (*Men only.*) Write out Euclid II. 3.
The square on the base of an isosceles right-angled triangle is equal to four times the area of the triangle.

(*Women only*). Compare the weekly household expenses of an agricultural labourer's family in the country with those of a town artisan's.

14. (*Men only.*) A triangular piece of ground whose sides are 800, 500, and 500 yards respectively is let for £30 per annum. What is the rent per acre? Ans. £1 4s. 2⅞d.

(*Women only.*) If I save £10 yearly and invest in the three per cents., and always put in the interest together with the savings for the four following years, what sum shall I have at the end of this period? Ans. £41 16s. 8·7048d.

15. (*a*) $\frac{5x-9}{8}+\frac{7x-1}{10}=\frac{11x+17}{15}+6.$ Ans. $14\frac{8}{11}$.

(*b*) $\frac{x-3}{5}+\frac{x-7}{3}=\frac{x-9}{7}+9.$ Ans. $27\frac{11}{31}$.

16. One number is the square of another, and their sum equals six times the smaller of the two. Find the numbers.
Ans. 5 and 25.

WEEK ENDING 27TH MAY 1893.

1. Analyse the following, and parse the italicised words:—

'O Scotia! my dear, *my* native *soil*,
For *whom* my warmest wish to Heaven *is sent!*
Long may thy hardy sons of rustic *toil*
Be *blest* with health and peace and sweet *content!*
And, *oh, may* Heaven their simple lives prevent
From luxury's contagion, weak and *vile!*
Then, howe'er crowns and coronets *be rent*,
A virtuous populace may rise the while,
And *stand*, a *wall* of fire, around *their* much loved isle.'—*Burns.*

2. Paraphrase the foregoing lines.

3. Draw a map of the Mississippi.

4. What do you know of Australian exploration?

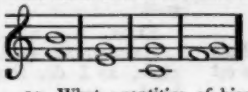
5. Relate the divisions and quarrels which led to the Battle of Bosworth. Give a brief account of the engagement.

6. Trace the growth of our colonial empire.

7. What are the chief qualifications necessary to make a good teacher?

8. Describe the qualities of good reading.

9. Place after each of the following intervals its inversion; and write under each of the latter its name and quality:—



| t | s | s | s ‖
| f | m | d | f

10. What quantities of biscuits at 4d., 5d., and 8d. per lb. will make a 10lb. tin of mixed biscuits worth 6d. per lb?
Ans. 2lb. at 4d., 4lb. at 5d., 4lb. at 8d.

11. In what time will £436 10s. amount to £558 18 $\frac{1}{20}$s. at 7 p.c. per annum, simple interest? Ans. 4½ years.

12. (*Men only.*) Write out Euclid I. 41.
If the points of bisection of the sides of a triangle be joined, the resulting triangles are each one-fourth of the original triangle.

(*Women only.*) Describe any simple methods of ventilation with which you are acquainted.

13. (*Men only.*) Write out Euclid II. 5.
Shew that in a parallelogram the squares on the diagonals are equal to the sum of the squares on all the sides.

(*Women only.*) Why is ventilation of rooms necessary? Give full reasons.

14. (*Men only.*) Find the number of turfs 4 feet by 8 inches required for a garden plot 50 feet by 75 feet, allowing for 4 circular beds, of 6 ft. diameter. Ans. 1363·8384 turfs.

(*Women only.*) A confectioner gained 60 p.c. by selling sugar-candy at 1¼d. per ounce, what per cent. would he have gained or lost by selling it at 8d. per lb. Ans. 36 p.c. loss.

15. If x^2+ax+b and x^2+cx+d have a common measure of the form $x+e$, show that $e=\frac{b-d}{a-c}$.

16. A regiment has sufficient food for m days. If it were re-inforced by p men it would only have food enough for n days. How many men were there at first?
Ans. $\frac{np}{m-n}$.

L'AVARE.

(*Molière.*)

TRANSLATED BY PROFESSOR DARQUÉ.—(*Author of 'Pupil Teachers' French Course.'*)

L'AVARE.

HARPAGON. Je vois bien que vous en avez ouï quelques mots. C'est que je m'entretenais en moi-même de la peine qu'il y a aujourd'hui à trouver de l'argent; et je disais qu'il est bien-heureux qui peut avoir dix mille écus chez soi.

CLÉANTE. Nous feignions[72] à vous aborder, de peur de vous interrompre.

THE MISER.

HARPAGON. I see clearly that you have heard some part of it. The fact is I was talking to myself about the difficulty there is at the present time to find money; and I was saying that he is very lucky who can have ten thousand crowns at home.

CLÉANTE. We were hesitating to speak to you lest we should interrupt you.

NOTES.

([72]) *Nous feignions. Feindre*, to hesitate, is growing obsolete in this sense. Its more general meaning is 'to feign,' 'to pretend.'

HARPAGON. Je suis bien aise de vous dire cela, afin que vous n'alliez pas prendre les choses de travers, et vous imaginer que je dise que c'est moi qui ai dix mille écus.

CLÉANTE. Nous n'entrons point dans vos affaires.

HARPAGON. Plût à Dieu que je les eusse, dix mille écus !

CLÉANTE. Je ne crois pas . . .

HARPAGON. Ce serait une bonne affaire pour moi.

ÉLISE. Ce sont des choses . . .

HARPAGON. J'en aurai bon[73] besoin.

CLÉANTE. Je pense que . . .

HARPAGON. Cela m'accommoderait fort.

ÉLISE. Vous êtes . . .

HARPAGON. Et je ne me plaindrais pas, comme je le fais, que le temps est misérable.

CLÉANTE. Mon Dieu, mon père, vous n'avez pas lieu de vous plaindre ; et l'on sait que vous avez assez de bien.

HARPAGON. Comment ? j'ai assez de bien ! Ceux qui le disent en ont menti. Il n'y a rien de plus faux ; et ce sont des coquins qui font courir tous ces bruits-là.

ÉLISE. Ne vous mettez point en colère.

HARPAGON. Cela est étrange, que mes propres[74] enfants me trahissent et deviennent mes ennemis ?

CLÉANTE. Est-ce être votre ennemi, que de dire que vous avez du bien ?

HARPAGON. Oui, de pareils discours, et les dépenses que vous faites, seront cause qu'un de ces jours on me viendra chez moi couper la gorge, dans la pensée que je suis tout consu[75] de pistoles.

CLÉANTE. Quelle grande dépense est-ce que je fais ?

HARPAGON. Quelle ?[76] Est-il rien de plus scandaleux, que ce somptueux équipage que vous promenez par la ville ? Je querellais hier votre sœur ; mais c'est encore pis. Voilà qui crie vengeance au ciel ; et, à vous prendre depuis les pieds jusqu'à la tête, il y aurait là de quoi faire une bonne constitution.[77] Je vous l'ai dit vingt fois, mon fils, toutes vos manières me déplaisent fort ; vous donnez furieusement dans le marquis ; et pour aller ainsi vêtu, il faut bien que vous me dérobiez.

CLÉANTE. Hé ! comment vous dérober ?

HARPAGON. Que sais-je ? Où pouvez-vous donc prendre de quoi entretenir l'état que vous portez ?

CLÉANTE. Moi, mon père ? c'est que je joue ; et, comme je suis fort heureux, je mets sur moi tout l'argent que je gagne.

HARPAGON. C'est fort mal fait. Si vous êtes heureux au jeu, vous en devriez profiter, et mettre à honnête intérêt l'argent que vous gagnez afin de le trouver un jour. Je voudrais bien savoir, sans parler du reste, à quoi servent tous ces rubans dont vous voilà lardé[78] depuis les pieds jusqu'à la tête ;

HARPAGON. I am very glad to tell you that, in order that you may not go and mistake things, and fancy that I say that it is I who have ten thousand crowns.

CLÉANTE. We do not meddle with your affairs.

HARPAGON. Would to God that I had ten thousand crowns !

CLÉANTE. I do not believe . . .

HARPAGON. It would be a good thing for me.

ÉLISE. Those are things . . .

HARPAGON. I greatly need them.

CLÉANTE. I think that . . .

HARPAGON. It would suit me very well.

ÉLISE. You are . . .

HARPAGON. And I should not complain, as I do, that times are very hard.

CLÉANTE. Really, father, you have no reason to complain ; and it is well known that you are pretty well off.

HARPAGON. What ? I am pretty well off ! Those who say so have told an untruth. Nothing is more false ; and they are rogues who spread those reports.

ÉLISE. Do not get angry.

HARPAGON. It is strange, that my own children betray me and become my enemies ?

CLÉANTE. Is one your enemy, because he says you are well off ?

HARPAGON. Yes, such speeches, and the money you spend, will be the cause that one of these days somebody will come and cut my throat in my own house, in the belief that I am made of gold.

CLÉANTE. What great expenses do I make ?

HARPAGON. What great expenses ? Is there anything more scandalous than that costly equipment which you display in the town ? Yesterday I was finding fault with your sister ; but it is still worse. That cries for vengeance from heaven ; and, if I take you from head to foot, there would be enough to constitute an income. I told you so twenty times, my son, all your manners displease me much ; you affect the marquis terribly ; and in order to be thus clothed, you must rob me.

CLÉANTE. What ! How can I rob you ?

HARPAGON. How do I know ? Where then can you get the wherewith to keep up the style of life you lead ?

CLÉANTE. I, father ? It is because I play (gamble) ; and, as I am very lucky, I spend upon myself the whole of the money I win.

HARPAGON. That is very wrong. If you are lucky at play, you ought to profit by it, and put out at an honest interest the money you win, in order to have it some day. I should very much like to know, without speaking of the rest, what is the use of all those ribbons with which you are decked from

(73) *Bon besoin.* We now say *grand besoin.*

(74) *Propre,* when placed after the noun means 'clean,' whereas, when it precedes it, it is rendered by 'own.'

(75) *Je suis tout consu de pistoles* may also be rendered by 'I am immensely rich.'

(76) *Quelle* is now never used without a noun; *lequel, laquelle,* &c., are now preferred when the noun is understood.

(77) *Constitution* has grown quite obsolete in this sense, *rente* or *revenu* are now used instead.

(78) *Lardé,* literally 'larded,' a rather familiar mode of expression.

et si une demi-douzaine d'aiguillettes ne suffit pas pour attacher un haut-de-chausses. Il est bien nécessaire d'employer de l'argent à des perruques, lorsque l'on peut porter des cheveux de son crû qui ne coûtent rien. Je vais gager qu'en perruques et rubans, il y a du moins vingt pistoles ; et vingt pistoles rapportent par année dix-huit livres six sols huit derniers, à ne les placer qu'au denier douze. [79]

CLÉANTE. Vous avez raison.

HARPAGON. Laissons cela, et parlons d'autre affaire. (*Apercevant Cléante et Élise, qui se font des signes.*) Hé ! (*Bas, à part.*) Je crois qu'ils se font signe l'un à l'autre de me voler ma bourse. (*Haut.*) Que veulent dire ces gestes-là.

ÉLISE. Nous marchandons, [80] mon frère et moi, à qui parlera le premier, et nous avons tous deux quelque chose à vous dire.

HARPAGON. Et moi, j'ai quelque chose aussi à vous dire à tous deux.

CLÉANTE. C'est de mariage, mon père, que nous desirons vous parler.

HARPAGON. Et c'est de mariage aussi que je veux vous entretenir. [81]

ÉLISE. Ah ! mon père !

HARPAGON. Pourquoi ce cri ? Est-ce le mot, ma fille, ou la chose, qui vous fait peur ? [82]

CLÉANTE. Le mariage peut nous fair peur à tous deux, de la façon que vous pouvez l'entendre ; et nous craignons que nos sentiments ne [83] soient pas d'accord avec votre choix.

HARPAGON. Un peu de patience. Ne vous alarmez point. Je sais ce qu'il [84] faut à tous deux ; et vous n'aurez, ni l'un ni l'autre, aucun lieu de vous plaindre de tout ce que je prétends faire. Et, pour commencer par un bout (*à Cléante*), avez-vous vu, dites-moi, une jeune personne appelée Mariane, qui ne loge pas loin d'ici ?

CLÉANTE. Oui, mon père.

HARPAGON. Et vous ?

ÉLISE. J'en ai ouï parler.

HARPAGON. Comment, mon fils, trouvez-vous cette fille ?

CLÉANTE. Une fort charmante personne.

HARPAGON. Sa physionomie ?

CLÉANTE. Tout honnête, et pleine d'esprit.

HARPAGON. Son air, et sa manière ?

CLÉANTE. Admirables, sans doute.

HARPAGON. Ne croyez-vous pas qu'un fille comme cela mériterait assez que l'on songeât à elle ?

CLÉANTE. Oui, mon père.

HARPAGON. Que ce serait un parti souhaitable ?

CLÉANTE. Très souhaitable.

HARPAGON. Qu'elle a toute la mine de faire une bon ménage ? [85]

CLÉANTE. Sans doute.

HARPAGON. Et qu'un mari aurait satisfaction avec elle ?

CLÉANTE. Assurément.

HARPAGON. Il y a une petite difficulté ; c'est que j'ai peur qu'il n'y ait

head to foot; and whether half-a-dozen points are not sufficient to fasten a doublet. Is it quite necessary to spend money in wigs, when one can wear one's own hair, which costs nothing ? I will bet that your wigs and ribbons cost at least eight pounds sterling ; and eight pounds bring yearly about fourteen shillings and sevenpence halfpenny, if they are lent only at about eight per cent.

CLÉANTE. You are right.

HARPAGON. Let us leave that *topic*, and speak of something else. (*Perceiving Cléante and Élise, who are making signs to one another.*) Hallo ! (*In a low tone, aside.*) I think they are making signs to each other to steal my purse. (*Aloud.*) What do those signs mean ?

ÉLISE. My brother and I are hesitating as to who shall speak first, and we both have something to tell you.

HARPAGON. And *I* also have something to tell you both.

CLÉANTE. It is of marriage, father, that we wish to speak to you.

HARPAGON. And it is of marriage that I also want to converse with you.

ÉLISE. Oh ! father !

HARPAGON. Why that cry ? Is it the word, my daughter, or the thing, that frightens you ?

CLÉANTE. Marriage may frighten us both, according to the manner in which you may understand it ; and we are afraid lest our sentiments should not be in accordance with your choice.

HARPAGON. A little patience. Be not alarmed. I know what you both require; and neither of you will have any reason to complain of all I intend to do. And, to begin at one end, (*to Cléante*) have you seen, tell me, a young person called Mariane, who does not live far from here ?

CLÉANTE. Yes, father.

HARPAGON. And you ?

ÉLISE. I have heard of her.

HARPAGON. How, my son, do you like that girl ?

CLÉANTE. She is a most charming person.

HARPAGON. Her physiognomy ?

CLÉANTE. Quite honest and full of wit.

HARPAGON. Her looks and her appearance ?

CLÉANTE. Admirable, undoubtedly.

HARPAGON. Do you not think that such a girl rather deserves that one should think of her ?

CLÉANTE. Yes, father.

HARPAGON. That it would be a desirable match ?

CLÉANTE. Most desirable.

HARPAGON. That she is most likely to live well with her husband ?

CLÉANTE. Doubtless.

HARPAGON. And that a husband would be satisfied with her ?

CLÉANTE. Assuredly.

HARPAGON. There is a little difficulty (drawback); I am afraid she has

(79) *Au denier douze*, that is to say, one *denier* has to be paid as interest for every twelve that were lent, which is equivalent to a trifle over eight per cent.

(80) *Marchandons* is growing obsolete in this sense.

(81) *Entretenir* would seem to imply that the conversation will prove interesting, whilst *parler* implies nothing of the kind.

(82) *Faire peur* is equivalent to *épouvanter* ; hence the absence of the article before the noun. Notice the expressions *faire allusion*, to allude ; *avoir faim*, to be hungry, etc.

(83) *Ne* is required before the verb of the subordinate whenever an idea of fear is to be expressed, if the principal sentence is neither interrogative nor negative. Hence we say: *je crains qu'il ne vienne.* I fear he will come ; *je ne crains pas qu'il vienne*, I do not fear he will come ; *craignez-vous qu'il vienne ?* Are you afraid he will come ?

(84) *Ce qu'il faut.* We would now say in preference *ce qu'il vous faut*, which is synonymous with *ce dont vous avez besoin.*

(85) *Ménage*, literally 'household.'

pas avec elle tout le bien qu'on pourrait prétendre.

CLÉANTE. Ah ! mon père, le bien n'est pas considérable, lorsqu'il est question d'épouser une honnête personne.

HARPAGON. Pardonnez-moi, pardonnez-moi. Mais ce qu'il y a à dire, c'est[86] que, si l'on n'y trouve pas tout le bien qu'on souhaite, on peut tâcher de regagner cela sur autre chose.

CLÉANTE. Cela s'entend.

HARPAGON. Enfin, je suis bien aise de vous voir dans mes sentiments ; car son maintien honnête et sa douceur m'ont gagné l'âme, et je suis résolu de[87] l'épouser, pourvu que j'y trouve quelque bien.

CLÉANTE. Euh ?

HARPAGON. Comment ?

CLÉANTE. Vous êtes résolu, dites-vous. . .

HARPAGON. D'épouser Mariane.

CLÉANTE. Qui ? Vous, vous ?

HARPAGON. Oui, moi, moi, moi. Que veut dire cela ?

CLÉANTE. Il m'a pris[88] tout à coup un éblouissement, et je me retire d'ici.

HARPAGON. Cela ne sera rien. Allez vite boire dans la cuisine un grand verre d'eau claire.

not as much property as one might have a right to expect.

CLÉANTE. Ah! father, fortune is not to be considered, when one means to marry an honest person.

HARPAGON. Pardon me, pardon me. But what is to be said is that, if one does not find with her all the property one wishes for, one may endeavour to make that up with something else.

CLÉANTE. That is understood.

HARPAGON. Lastly, I am very glad to see you share my sentiments; for her honest deportment and gentleness have won my heart, and I have made up my mind to marry her, provided she has some property . . .

CLÉANTE. Oh !

HARPAGON. What ?

CLÉANTE. You have made up your mind, do you say . . .

HARPAGON. To marry Mariane.

CLÉANTE. Who ? You, you.

HARPAGON. Yes, I, I, I. What does that mean ?

CLÉANTE. I have just had a sudden fit of dizziness, and I withdraw from here.

HARPAGON. It will be nothing. Go quickly into the kitchen, and drink a large tumbler of pure water.

(86) *Ce qu'il y a . . . c'est.* Notice the repetition of *ce* before *est*, a repetition which is obligatory whenever the sentence begins with that word.

(87) *Je suis résolu de.* We would now say *j'ai résolu de*, though a great many prefer *je suis résolu à.*

(88) *Il m'a pris.* The impersonal form of the verb is of frequent occurrence in French, and is probably resorted to in order to give greater energy to the expression.

SCÈNE VI.

HARPAGON, ÉLISE.

HARPAGON. Voilà de mes damoiseaux fluets, qui n'ont non[89] plus de vigueur que des poules. C'est là, ma fille, ce que j'ai résolu pour moi. Quant à ton frère, je lui destine une certaine veuve dont, ce matin, on m'est venu parler ; et, pour toi, je te donne au seigneur[90] Anselme.

ÉLISE. Au seigneur Anselme ?

HARPAGON. Oui ; un homme mûr, prudent et sage, qui n'a pas plus de cinquante ans, et dont on vante les grands biens.

ÉLISE (*elle fait une révérence*). Je ne veux point me marier, mon père, s'il vous plaît.

HARPAGON (*il contrefait sa révérence*). Et moi, ma petite fille, ma mie, je veux que vous vous mariiez, s'il vous plaît.

ÉLISE (*faisant encore la révérence*). Je vous demande pardon, mon père.

HARPAGON (*contrefaisant Élise*). Je vous demande pardon, ma fille.

ÉLISE. Je suis[91] très humble servante au seigneur Anselme ; mais (*faisant encore la révérence*), avec votre permission, je ne l'épouserai point.

HARPAGON. Je suis votre très humble valet ; mais (*contrefaisant Élise*), avec votre permission, vous l'épouserez dès ce soir.

ÉLISE. Dès ce soir ?

HARPAGON. Dès ce soir.

ÉLISE (*faisant encore la révérence*). Cela ne sera pas, mon père.

SCENE VI.

HARPAGON, ÉLISE.

HARPAGON. There is one of those weakly fops, who have no more strength than rats (hens). That is, my daughter, what I have resolved for myself. As for your brother, I intend to give him a certain widow of whom I heard this morning ; and, as for you, I give you to Mr. Anselme.

ÉLISE. To Mr. Anselme ?

HARPAGON. Yes, a staid, prudent, and wise man, who is not more than fifty years of age, and whose fortune is well known.

ÉLISE (*bowing*). I do not wish to marry, father, if you please.

HARPAGON (*mimicking her bow*). And I, my little daughter, my friend, will have you marry, if you please.

ÉLISE (*bowing again*). I beg your pardon, father.

HARPAGON (*mimicking Élise*). I beg your pardon, my daughter.

ÉLISE. I am Mr. Anselme's most humble servant ; but (*again bowing*) with your permission, I will not marry him.

HARPAGON. I am your most humble servant, but (*mimicking Élise*) with your permission, you shall marry him this very evening.

ÉLISE. This very evening ?

HARPAGON. This very evening.

ÉLISE (*again bowing*). That shall not be, father.

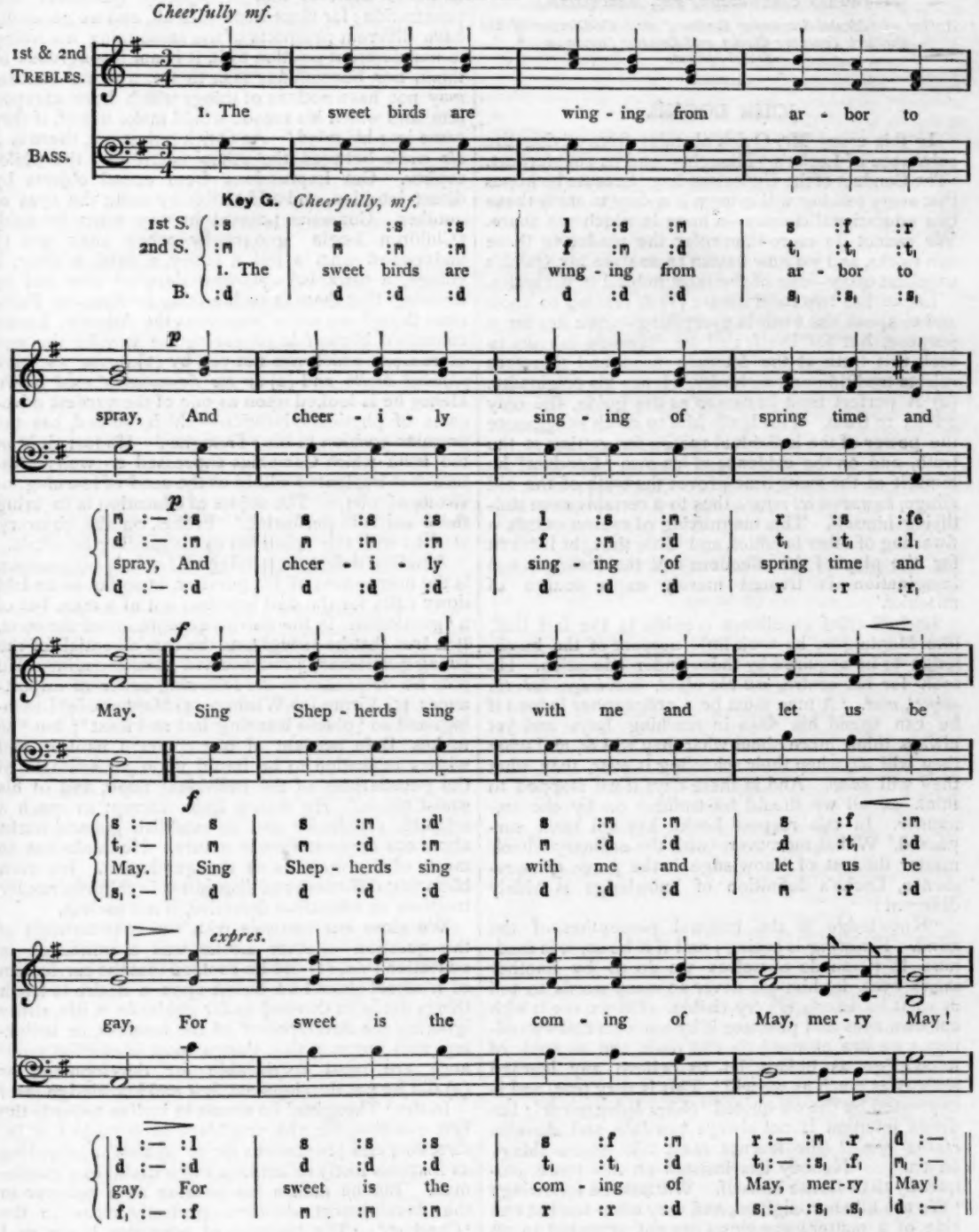
(*To be continued.*)

(89) *N'ont non plus* is a mode of expression to be avoided. Everyone would now say *n'ont pas plus.*

(90) *Seigneur*, literally 'lord,' a title formerly often bestowed on wealthy or elderly people of eminence who had no titles of nobility.

(91) *Très humble servante au . . .* We now say *très humble servante du . . .*

SPRING TIME AND MAY.


Cheerfully mf.
1st & 2nd TREBLES.
BASS.
1. The sweet birds are wing - ing from ar - bor to
Key G. Cheerfully, mf.
1st S. :s | s :s :s | l :s :m | s :f :r
2nd S. :m | m :m :m | f :m :d | t1 :t1 :t1
1. The sweet birds are wing - ing from ar - bor to
B. :d | d :d :d | d :d :d | s1 :s1 :s1
p
spray, And cheer - i - ly sing - ing of spring time and
p
m :— :s | s :s :s | l :s :m | r :s :fe
d :— :m | m :m :m | f :m :d | t1 :t1 :l1
spray, And cheer - i - ly sing - ing of spring time and
d :— :d | d :d :d | d :d :d | r :r :r1
f
May. Sing Shep - herds sing with me and let us be
f
s :— | s | s :m :d' | s :m :m | s :f :m
t1 :— | m | m :d :m | m :d :d | d :t1 :d
May. Sing Shep - herds sing with me and let us be
s1 :— | d | d :d :d | d :d :d | m :r :d
expres.
gay, For sweet is the com - ing of May, mer - ry May!
l :— :l | s :s :s | s :f :m | r :— :m .r | d :—
d :— :d | d :d :d | t1 :t1 :d | t1 :— :s1 .f1 | m1 :—
gay, For sweet is the com - ing of May, mer - ry May!
f1 :— :f | m :m :m | r :r :d | s1 :— :s1 .s1 | d :—

2. Companions to meet us are now on the way,
With garlands to greet us and songs to sweet May,
Sing Shepherds, sing with me and let us be gay,
For sweet is the coming of May, merry May!

3. The cattle are lowing, come up from your hay,
And quickly be going, the morning is May;
Sing Shepherds, sing with me and let us be gay,
For sweet is the coming of May, merry May!

QUICK'S EDUCATIONAL REFORMERS.

BY THOMAS CARTWRIGHT, B.A., B.SC. (LOND.)

Author of 'Mental Science for Teachers,' etc. Co-Director of the Birkbeck Training Classes, and Lecturer therein on School Method.

JOHN LOCKE.

In this essay Mr. Quick abstains from giving the substance of Locke's 'Thoughts' and its counterpart, 'The Conduct of the Understanding,' because he hopes that every teacher will esteem it a duty to study these two educational classics—a hope in which we share. We cannot do more than refer the reader to these two works, and we now hasten to analyse Mr. Quick's excellent essay—one of the most helpful of his series.

Locke has two fixed ideas: (1) A craving to know and to speak the truth in everything—truth not for a purpose, but for itself; and he earnestly labours to seek this truth at the fountain head, and therefore rejects tradition and authority. Hence his originality. (2) A perfect trust in reason as the guide, the only guide, to truth. This leads him to much exaggerate the power of the individual reason for getting at the truth, and on the evidence of his own 'Conduct' he himself at the same time proves the truth of the old adage, *humanum est errare*, thus to a certain extent stultifying himself. This magnifying of reason causes a dwarfing of other faculties, and 'little thought is taken for the play of the affections and the feelings, and imagination is treated merely as a source of mischief.'

Locke's chief excellence consists in the fact that, like Montaigne, he took little account of the knowledge to be acquired by those under education. He took for his centre, *not the object, knowledge, but the subject, man.* 'A man must be a philosopher indeed if he can spend his days in teaching boys and yet always think more about what they will *be*, and what they will *do*, when their schooling is over, than what they will *know*. And in these days if we stopped to think at all we should be trodden on by the examiner. In this respect Locke has not been surpassed.' Whilst, moreover, 'with the ordinary schoolmaster the test of knowledge is the *power of reproduction*, Locke's definition of knowledge is widely different:

'Knowledge is the internal perception of the mind. Knowing is seeing; and if it be so, it is madness to persuade ourselves we do so by another man's eyes, let him use never so many words to tell us what he asserts is very visible. Till we see it with our own eyes and perceive it by our own understandings, we are as much in the dark and as void of knowledge as before, let us believe any learned authors as much as we will.' This is very true, and is expressed by the oft-quoted '*things before words*'; but direct intuition is not always possible, and *discentem credere oportet* (the learner must take some things on trust). Nobody has insisted on this more eloquently than Locke himself. Witness the following: 'We are all short-sighted, and very often see but one side of a matter; our views are not extended to all that has a connection with it. From this defect no man is free. We see but in part, and we know but in part; and therefore it is no wonder that we conclude not right from our partial views. This might instruct the proudest esteemer of his own parts how useful it is to talk and consult with others, even such as come short of him in capacity, quickness, and penetration; for since none sees all, and we generally have different prospects of the same thing according to our different position to it, it is not incongruous to think, nor beneath any man to try, whether another may not have notions of things which have escaped him, and which his reason would make use of, if they came into his mind.' As Quick points out, there is a *via media* between the schoolmaster and the philosopher. Get impressions from actual objects by direct intuition, and add to this by using the eyes of another. Comenius pointed the way when he said, 'Children begin geography when they get to understand what a hill, a valley, a field, a river, a village, a town is.' Starting thus, we may end by knowing that there is such a thing as Niagara Falls, even though we never may cross the Atlantic. Locke contented himself in preparing the way for the age of reason, which was not yet, by (1) *caring for their physical health* and (2) *by the formation of good habits.* Hence he is looked upon as one of the earliest advocates of physical education—which, indeed, has the premier position in his 'Thoughts.' He lost sight of the truth which Comenius expressed so well: 'Nature has implanted within us the seed of learning, of virtue, of piety. The object of education is to bring these seeds to perfection.' Fröbel, on the contrary, worked with this aphorism as his guiding principle.

A radical defect, underlying all Locke's suggestions, is the narrowness of his purview, in so far as he laid down rules for the development, not of a man, but of a 'gentleman' in the narrow acceptation of the term. It is true that he 'sought, as the true essential for the young gentleman,' prudence and good breeding. He puts his requisites in the following order of importance: (1) Virtue, (2) Wisdom, (3) Manners, (4) Learning, and so 'places learning last and least'; but 'he makes little account of our common nature, and wishes education to be based upon an estimate of the peculiarities of the individual pupil, and of his social needs.' He makes little attempt to reach a scientific standpoint and to establish general truths about our common human nature. He thinks not so much of the man, as of the gentleman. He even hints that differences of disposition in children render treatises on education defective, if not useless.

We close our analysis with the consideration of the question whether Locke was a utilitarian in education; *i.e.*, (1) did he contend that the curriculum of a school should be based upon a desire to teach things useful in themselves for guidance in life, either ignoring the development of the faculties, or believing, with Spencer, that things most useful for guidance are most serviceable for development, or (2) did he put development first and knowledge last?

In the 'Thoughts,' he seems to incline towards the first position, for 'he considers each subject of instruction, and pronounces for or against it according as it seems likely or unlikely to be useful to a gentleman.' But he makes his position as a believer in the development doctrine perfectly clear in the 'Conduct.' 'The business of education is not, as I think, to make the young perfect in any one of the sciences, but so to open and dispose their minds as may best make them capable of any when they shall apply themselves to it.' In other words, his aim is

'an increase of the powers and activity of the mind, not an enlargement of its possessions.' The so-called 'Pisgah Vision' is eloquent testimony as to Locke's earnestness and singleness of purpose. We need no laboured arguments to prove that

'A man he was to all the country dear.'

LONDON MATRICULATION.

JUNE, 1893.

OUR PREPARATION CLASS FOR PRIVATE STUDENTS.

BY T. RUSSELL MALTBY, M.A.
Head Master, Trowbridge High School.

(THIRD MONTH.)

I. LATIN.

Notes on March Work.

De Senectute, §§ 39–85 (Dr. Reid). *Supplementary Notes.*

§ 39. *Senectutis:* subj. gen. *Aetatis:* obj. gen. *Nullam capitaliorem:* the reported speech extends to *exstingueret* in § 41, dependent on three main verbs *dicebat, iubebat, censebat;* turn the whole passage into *oratio recta. Voluptatem corporis: bodily pleasure. Cuius voluptatis;* obj. of *potiendum: and to obtain this pleasure greedy desires were set in motion.*

§ 40. *Nullum denique, etc.: in a word there was no. Ad quod suscipiendum:* the gerundive construction; *which the desire of pleasure did not impel men to undertake. Nisi (illecebris) voluptatis.* Mark the note on *scelus, facinus* and *flagitium.*

§ 41. *Libidine dominante:* abl. abs. *Quo:* for *ut*, with a comparative: *and that this might be better understood. Maxima:* redundant in English. *Dubium:* why a *quin* clause here, and not acc. with inf.? A. and H. § 244. *Haec cum, etc.: such were the words of Archytas to C. Pontius the Samnite, father of the general by whom our consuls Sp. P. and T. V. were defeated in the Caudine Forks; my friend, Nearchus of Tarentum, who remained loyal to the Roman people, used to say that he had the account from his elders; the conversation took place when Plato the Athenian was present, who, I find, came to Tarentum in the consulship of L. C. and Ap. C.*

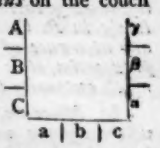
§ 42. *Magnam esse, etc.: that we should be very grateful to old age,* cf. § 46 and see Dict. for *gratiam habere. Efficeret:* causal. *Liberet:* consecutive. *Oporteret (libere). Ut ita dicam, etc.: so to say, the eyes of the mind. Invitus feci ut: it was unwillingly that I . . . Eicerem:* compounds of *iacio (—iicio)* are spelt with one *i*, but pronounced with two. *Mihi vero et: but in my view and that of.* Mark the notes on various subjunctives.

§ 43. Analyse this very complex opening: *dicebant*—(1) *audisse*—(2) *solitum*—(3) *mirari*—(4) *quod audisset*—(5) *quendam esse*—(6) *qui profiteretur;* there are six degrees of dependency in the verbs; *cum esset* comes in after the fourth; at (5) a parallel series begins, viz., (5) *eum dicere*—(6) *omnia esse referenda*—(7) *quae faceremus.* In the next sentence, which is still dependent on *audisset*, dependency is carried to the tenth degree: (5) *Solitos*—(6) *optare*—(7) *ut persuaderetur*—(8) *quo facilius possent*—(9) *vinci*—(10) *cum dedissent. Tum ex eius, etc.: as well as from the deed of the Decius I have named.*

§ 44. *Vituperatio nulla: no charge against old age, but even the highest praise in the fact that . . . Quae sumpserat:* observe that Cic. is here quite at variance with Livy.

§ 45. *Sacris Idaeis, etc.: when the Idaean rites of the Great Mother were introduced. Bene enim maiores, etc.: for our ancestors rightly named the reclining of friends at feasts "convivium," seeing that it involved . . . In eo genere: in the matter.* Mark the notes on *sodales, Magnae Matris.*

§ 46. *Qui pauci, etc.: of whom very few remain. Atque vobiscum: and with you especially. Delectant:* the subjects are (1) *magisteria*, (2) *is sermo*, (3) *pocula minuta et rorantia*, (4) *refrigeratio*, (5) *sol aut ignis.* The notes here must be mastered. On *is sermo* Dr. Reid implies that the cup started from the guest who was *summus* on the couch which was *summus.* A B C, *lectus summus;* a b c, *lectus medius;* α β γ, *lectus imus;* also, of the guests, A, a, α, were each called *summus;* B, b, β, each called *medius;* C, c, γ, each called *imus. Quod ad multam noctem, etc.: which we prolong as late into the night as we can.*



§ 47. *At: but still. Bene Sophocles: that was a worthy reply of S.* Compare the subj. in *quod non desideres* with the indicative in *qui non desiderat.*

§ 48. What is the argument here? What constructions follow *carere, quaerere, frui, potiri, ingredi, triumphare? Turpione Ambivio:* why abl. without *ab? Tantum quantum sat est: quite as much as is right.* Mark the note on *cavea*, and the anachronism.

§ 49. *Quanti:* A. & H. § 127; so *pluris*, § 61. *Animum tamquam emeritis, etc.: for the mind, having completed its time, as it were, in the service of . . . Studi atque doctrinae: in some pursuit or research. Ingressum = cum coepisset.*

§ 50. *Quid (dicam). Qui cum sex, etc.: I have also seen Livius in his old age, for although he brought out a play six years before I was born, in the consulship of C. and T., he lived on . . . Quid de P.:* notice how far the preposition may be separated from its noun (*studio*). *Pontifici:* distinguish noun and adjective. *Quanto studio: with what eagerness did we see him practise himself in oratory even in his old age.*

§ 51. *Alias minore (cum faenore). Cum:* why followed by indic.? *Gremio:* what case? Work out a careful rendering of this passage.

§ 52. *Vim ipsam . . quae . . procreet:* consec. subj. *Quam serpentem: and when it creeps.* Make sure of your vocabulary here.

§ 53. *Nec modico . . et: is sure of moderate . . . and yet. Cum fructu . . tum: both . . and.*

§ 54. *Colentem . . facit: represents him as cultivating.*

§ 55. *Ea quae dixi: even what I have said. Nam et studio. . . et: for I have been carried away . . . and besides. Vindicare:* study this word in Dict. *Hac vita: in this kind of life. Extremum tempus: the last years.*

§ 56. *Poteratne:* make sure of this sentence (see note). *Si quidem: since,* as in § 49. *Cuius dictatoris iussu: and it was by his command, as dictator, that. Mea sententia:* abl. *Nulla (senectus). Ut, quoniam, etc.:* editors differ here, but the indication given in the note leads to a very natural meaning; the regular meaning of *in gratiam redire cum aliquo* is *to reconcile oneself with a person;* translate freely, *I mention these attractions because certain people find them wanting in old age, and by way of making our peace with pleasure. Semper enim, etc.: for a good and careful master always has his storerooms for wine, oil, and provisions well filled.* Mark the notes on *viatores, succidiam.* Parse *referta.*

§ 57. *Agro culto:* abl. of comparison. *Ad quem fruendum:* is *fruendum* gerund or gerundive?

§ 58. *Habeant:* jussive; *let them keep their armour and their horses and their spears. Id ipsum, etc.: and even that as it shall please them.*

§ 59. *Quaeso:* parenthetically after an imperative; *which I urge you to continue to read with attention, as you are*

doing. In eo libro, etc.: in that book on the care of property which is entitled O: Socrates loquitur: reported speech to the end of the section.

§ 60. *Quo minus:* A. & H. § 244. *Cum esset, etc.: living in the fields and cultivating them after his years of vigour were spent, between whose first and sixth consulships . . . Ita quantum, etc.: thus as long as was the space which our ancestors reckoned upon from birth to the beginning of old age . . . Illi:* of course dative. *Hoc beatior: hoc* (abl.) is explained by the *quod* clause and may be omitted.

§ 61. *Incisum: as engraved. Gravis (erat): was his influence great. Quem virum, etc.: what a man we saw lately in P. C. Quorum, etc.: authority lay not only in any utterance of theirs, but even in their nod. Honorata praesertim, etc.: especially distinguished old age, enjoys so much authority that it is worth more than . . .*

§ 62. *Miseram, etc: that that was a wretched old age whose defence was in words. Non cani, etc.: it is not a hoary head nor wrinkles that can . . .*

§ 63. *Ut quaeque, etc: in proportion to the true civilisation of each is the care with which they are studied;* sentences containing *quisque* with a superlative should be carefully noticed. *Locum nusquam datum (esse).*

§ 64. *Plausus multiplex: rounds of applause. Essent:* ind. quest. *Neque solum honore, etc.: nor were the older augurs placed before those only who held higher office, but even before those who held the imperium. Fabulam, etc.: to have played to the end the drama of life, and not broken down like unpractised actors in the last act; eis* (before *mihi*) must be a misprint for *ei* (nom.)

§ 65. *Morum: of character. Quae tamen, etc.: and yet all these can be sweetened both by . . . Severitatem . . . modicam: seriousness . . . but not in excess. Avaritia vero senilis, etc.: but what avarice means in an old man;* ind. quest. *Quo viae, etc.: the less there remains of the journey, the more to . . .*

§ 66. *Qui . . . non viderit:* why subj.? *Neglegenda: to be ignored. Aliquo:* adv. Mark the derivation of *sollicitus.*

§ 67. *Timeam:* deliberative subj. *Si aut, etc.: if I am to be either not miserable or else happy. Cui sit exploratum:* see Dict.; *as to feel certain. Pluris:* acc. pl. *Casus mortis: chances of death. Tristius curantur: suffer more in being cured.*

§ 68. *Expectatis ad: destined in the expectation of men to attain to. At senex, etc.: but you will say an old man has not even anything to hope for;* contrast this subj. with *quod ille sperat* below. *At est eo: yes, but he is for that reason;* notice *meliore condicione* without prep.

§ 69. *Da supremum tempus: grant the utmost length of life, suppose we look for* (jussive subj.) *Fuit enim ut scriptum video: for I read that there was. Sed mihi, etc.:* commit this passage to memory. *Quod temporis:* together; A. & H. § 141, Note 2.

§ 70. *Ut placeat:* final; *for an actor need not go through the whole play to give satisfaction, so long as he secures approval in the particular act in which he has appeared.*

§ 71. *Ante:* adv. with participle *partorum. Partorum:* see Dict., where the examples cited will determine the meaning to be *blessings already obtained. Quid est autem, etc.:* make a note of this sentence for Lat. Comp.; how will you classify the dative *senibus? Adversante natura:* what is the argument? *Itaque adulescentes, etc.:* elaborate your translation here. What is the construction of *aufert?*

§ 72. *Illi quaerenti:* ind. obj. of *respondisse. Qua re:* gov. by *fretus. Sibi:* gov. by *obsisteret. Senectute* takes up the case of *qua re.* For *tandem* in questions see Dict. *Cum integra, etc.: when the intellect is unimpaired and the senses unfaltering, and the same nature which cemented us together with her own hands disjoins her work.*

§ 73. *Vetatque:* learn this in the Latin; Plato's Greek is, ἐν τινι φρουρᾷ δεῖν οἱ ἄνθρωποι καὶ οὐ δεῖ δὴ ἑαυτὸν ἐκ ταύτης λύειν οὐδὲ ἀποδιδράσκειν. *Quo se negat, etc.: in which he says that he does not wish his death to be unmarked by the grief and lamentations of friends. Volt se esse carum suis:* Dr. Reid's note is not convincing; surely the meaning is *his wish is that he may be dear to his friends. Haud scio an, etc.: I am inclined to think that Ennius's wish was a better one. Quam . . . consequatur:* like *qui viderit* in § 66; *that that death is to be bewailed which is followed by immortality.* Mark the note on *faxit.*

§ 74. *Aut optandus aut nullus: either desirable or non-existent. Tranquillo animo:* abl. of description. Notice the adverb *qui; how will a man who fears . . . be able.*

§ 75. The argument of course breaks down here. The examples cited only prove that there are some motives stronger than the fear of death; cf. Bacon's Second Essay, in the passage beginning, "It is worth the observing that there is no passion in the minde of man, so weake, but it Mates, and Masters, the Feare of *Death.*" *Disputatione:* A. & H. § 55. *Cum recordor, etc.:* when I call to mind, not distinguished heroes, but the rank and file of our armies, *who have often set forth cheerfully and unflinchingly for a place from which they thought that they would never return.*

§ 76. *Omnium rerum satietas:* cf. Bacon again: "A man would die, though he were neither valiant, nor miserable, onely upon a wearinesse to doe the same thing, so oft over and over."

§ 77. *Sentiam:* ind. quest. in ind. quest. *Quod eo cernere, etc.: because I seem to see more clearly the nearer I am to it. Et eam quidem vitam, etc.: vitam,* cogn. acc.; for *quidem,* see Dr. Reid's note on § 65, l. 26, and look up the references; *and such life too as is alone worthy to be called life. Nam dum sumus inclusi, etc.:* learn this passage.

§ 78. *Nostros: of our country. Quae . . . disseruisset: the arguments which S. had discussed. Prudentia: foresight. Semper agitetur:* Cicero's translation of ἀειδίνητον, *is always active, and has no beginning of motion;* the sentence is in or. abl. *Quicquam admixtum, etc.: any admixture of what is different or dissimilar to itself.*

§ 79. *Nolite arbitrari:* A. & H. § 220.

§ 80. *Si nihil, etc.: if the souls of those very men had no power to make us . . . Mihi, etc.:* lit., *to me it could never be persuaded;* Allen § 119. *Ceterarum, etc.: it is clear to what each one of the other parts goes.*

§ 81. *Dormientium animi: our minds when we are asleep. Una* (adv.) *cum corpore.*

§ 82. *Tanta esse conatos, etc.: attempted those great enterprises which concerned their reputation with posterity unless they saw that posterity concerned them. Ni ita se haberet, etc.:* subj. *quod; if it were not the case that our souls are immortal;* notice the tenses.

§ 83. A. & H. § 176. *Aequissimo animo . . . iniquissimo: with the greatest tranquillity . . . reluctance. Quo quidem, etc.: and when I am on my way to them nothing I am sure will easily succeed in drawing me back.*

§ 84. *Habeat sane (aliquid commodi): but supposing that it has. Commorandi:* why gen.? *quo . . . pietate:* comparison . . . respect. *Mihi ipsi:* dat. of agent with *veniendum. Non quo: not because.*

§ 85. *Cuius:* obj. gen. *Adiuncta satietate:* abl. abs.; lit., *satiety being added (to weariness);* translate thus—*and we ought to avoid weariness in it, especially weariness accompanied by a feeling of disgust.*

QUERIES. To translate—(1) I wondered what was the reason why you had stopped sending me letters; (2) And there was no other reason for the discontinuance of my letters, except that I really did not know where you were. (3) If the gods in our prosperity gave us good sense as well, we should consider not only what had happened, but what might happen.

(1) *Mirabar quid esset quod tu mihi litteras mittere intermisisses;* (2) *Neque alia ulla fuit caussa intermissionis epistolarum, nisi quod ubi esses, plane nesciebam.* (3) *Si in secundis rebus bonam quoque mentem darent di, non ea solum quae evenissent, sed etiam ea quae evenire possent reputaremus.*

Latin Course for April.

1. *Allen's Grammar*, §§ 149—155. "Principal Parts," and Genders. Also as much as possible of §§ 196—299.

2. *Allcroft and Haydon*, §§ 135—205.

3. *Allcroft and Haydon, Exercises VI., VII., VIII., IX., X.* One sentence out of three.

4. *Cicero: pro Archia. Introduction and Translation of* §§ 1—16.

5. *Translation at Sight.* Regular practice.

II. GREEK.

Course for April.

1. *Abbott and Mansfield*, §§ 117—162. §§ 129—146 are of less importance than the rest. The verbs in -μι and §§ 159—162 must be thoroughly known.

2. *Abbott and Mansfield's Syntax*, §§ 53—141.

3. *Xenophon, Anabasis I. Chapters VI., VII., and VIII.* (to § 13.) Written translation.

4. *Translation at Sight.* Regular practice.

II. FRENCH.

Course for April.

1. *Breymann's Grammar. Chapters III.* (Nouns), *IV.* (Adjectives), *V.* (Pronouns, to the end of Possessives).

2. *Written Translation.* About three pages a week.

3. *More Rapid Translation.* About six pages a week

4. *Word-lists.* An extensive vocabulary is indispensable.

III. ENGLISH.

Notes on March work.

Mason, §§ 24—179.

§ 30. It will be seen from H. & B.'s notes that there is no satisfactory classification of Nouns; difficulties must be expected, and *many nouns cannot be classified absolutely;* they must be examined in a context, e.g. *north* and *south* will be sometimes abstract, sometimes concrete.

§ 31. *Astronomy* and *January* are certainly Connotative and therefore not Proper, yet they do not answer to the definition of Common Nouns.

§ 32. Sweet divides Nouns into Concrete and Abstract, and classifies Concrete Nouns as follows:—

concrete { common nouns { class-nouns { individual / collective } / material nouns } / proper names }

Observe the word *singular* in the definition of a Collective Noun. Words like *bundle* and *bunch* are not reckoned Collective, probably because no prominence is given to the individual parts of the collection. Except when a Collective Noun in the singular takes a plural verb, there is no need to use the term.

§ 33. Most Abstract Nouns may be easily classified as attribute-words (as *hardness*) or phenomenon-words (as *growth*). *Space* and *Time* had better be classed as Abstract, but divisions of them, as *mile*, *minute*, as Concrete.

§ 40. Be clear about the distinction between *natural gender* and *grammatical gender*. Even in English gender is not always according to sex; for instance, we generally speak of a ship as *she;* this usage must be distinguished from personification, § 42.

§ 44. It will be seen that *husband*, *lord*, *drake* are to be classed with the disguised compounds given in § 301.

§ 48. The only trace of a *dual* in Modern English is in the reciprocal *each other*, which is used of two, whereas *one another* is used of more than two.

§ 49. The rules for nouns in *f* are troublesome; if the noun is Teutonic and the *f* is *not* preceded by (1) a short vowel, (2) *oo*, (3) *f*, (4) *r*, then the plural ends in *-ves*. But there are exceptions: nouns in *-rf* formerly made a plural in *-ves*, and sometimes keep that form.

Stave is an instance of a singular formed from a plural; *staff* made a plural *staves;* the meanings diverged, and *staves* developed a new singular *stave*, while *staff* developed a new plural *staffs*. *Pea* is another singular formed from a plural; cf. also forms like *Chinee* from *Chinese*.

§ 53. These are what Sweet calls *mutation-plurals*.

§ 55. Notice that many foreign plurals have no singular: *aborigines*, *addenda*, *agenda*, *anthropophagi*, *antipodes*, *ephemera*. What is the pural of *census*, *crocus*, *fungus*, *prima donna*?

§ 59. Of these *apparent plurals*, *riches* and *eaves* are never, *alms* is rarely, *summons* is commonly, used in the singular.

§ 76. *Calvesfoot*, *calveshead* are good instances of the survival of the old genitive; cf. *calf's leg*.

§ 91. (*b*) Learn this list of Quantitative Adjectives, and notice that some are *Determinate* (*all*, *half*, *both*, *none*), some *Indeterminate* (*any*, *some*, *few*, &c.).

§ 92. Study all the meanings of *some:* in *I have some pens*, it is Indefinite and *some pens* is simply the plural of *a pen;* in *some people say*, it means *some but not all;* in *some village Hampden*, it is equivalent to the Indefinite Article; in *there is still some hope*, it means *some but not much*.

§ 98. Learn the whole of this section and supplement from H. & B.

§ 115. Irregular Comparison: learn all the footnotes and observe that superlatives in *-most* usually have no positive. The connection between *much* and A. S. *micel* is shown in the name *Mitchell*, which originally meant *big*, *tall*. The O. E. *fyrmest* became in middle E. *formest* owing to the influence of *forma* and *fore*. Superlatives like *æftemest*, *nithemest* became (phonetically) *aftermost*, *nethermost;* then *undermost* was formed on the analogy of *nethermost*, and *-ermost* became established as a superlative ending; hence *lowermost*, *furthermost*, &c. *Furthermost* was supplied with a comparative *furthermore*.

§ 117. This should be learnt. Adjectives of two syllables, which are *not* inflected are—(1) those in *-ful*, (2) those in *-ed*, (3) those in *-ing*, (4) generally words with heavy consonant-endings, as *distinct*, *abrupt;* cf. *polite*, *severe*.

§ 127. Pronouns are very important. Make sure of the table. Trace all modern forms back to the A. S. Study the following especially, §§ 140, 141, 148, 149, 152, 157, 177.

§ 131. Strictly speaking, other Pronouns might be called Personal. Which are they?

§ 144. Sweet calls the forms *my*, *thy*, &c. *conjoint*, the forms *mine*, *thine*, &c. *absolute*. Beware of calling the latter pronouns.

§ 177. Why are the Reflectives *himself*, *herself*, *itself*, *oneself*, *themselves*, classed as Adjective, and the rest as Substantive forms?

English Course for April.

1. *Mason*, §§ 180—341. Verbs, Adverbs, Prepositions, Conjunctions, Composition and Derivation.

2. *Hewitt and Beach*, *pp.* 108—259 and 594—641, omitting 612—621.

3. *Analysis* and *Prosody*. Occasional practice.

4. *Ransome's History, to* 1603, *with the Geography pertaining thereto.*

IV. MATHEMATICS.

Notes on Euclid, Book II.

Students should be quite familiar with the two theorems on pp. 145, 147. The latter is often very serviceable. Take, for instance, exercises 25, 28 and 33 (pp. 147, 148).

Ex. 25. The sum of the squares on the sides of a parallelogram is equal to the sum of the squares on the diagonals.

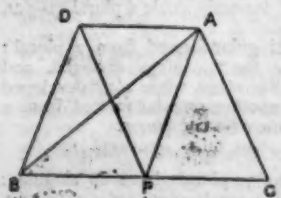


FIG. 1

Let BDAP be the parallelogram.
Draw AC parallel to DP; produce BP to meet AC in C.
Then BP = DA (I. 34), and DA = PC (I. 34);
∴ BP = PC.
Hence, by previous theorem (Ex. 24),
sq. on AB + sq. on AC = twice sq. on BP + twice sq. on PA;
but sq. on AC = sq. on DP;
∴ sq. on AB + sq. on DP = twice sq. on BP + twice sq. on PA = sum of squares on the four sides of the parallelogram.

Ex. 28. The sum of the squares on the sides of a quadrilateral is greater than the sum of the squares on its diagonals by four times the square on the straight line which joins the middle points of the diagonals.

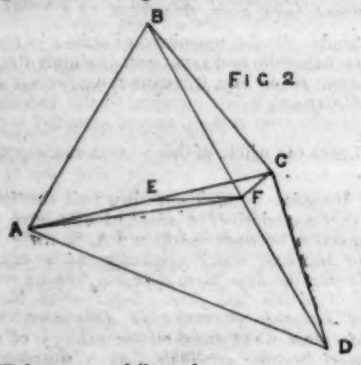


FIG 2

Let ABCD be any quadrilateral,
E, F the middle points of the diagonals.
Then, in △ABD,
sq. on AB + sq. on AD = twice sq. on AF + twice sq. on FB,
and, in △BCD,
sq. on BC + sq. on CD = twice sq. on CF + twice sq. on FB;
∴ sum of sqs. on AB, BC, CD, DA = twice sum of sqs. on AF, CF + 4 times sq. on FB.
= 4 times sq. on AE + 4 times sq. on EF + 4 times sq. on FB.
= sq. on AC + sq. on BD + 4 times sq. on EF.

Ex. 33. Three times the sum of the squares on the sides of a triangle is equal to four times the sum of the squares on the medians.

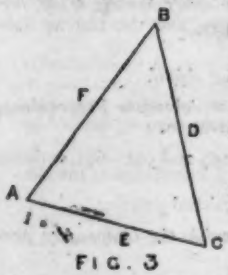


FIG. 3

Let ABC be a △, and D, E, F the middle points of its sides.
Then sq. on AB + sq. on AC = 2. sq. on BD + 2. sq. on DA,
∴ 2. sq. on AB + 2. sq. on AC = 4. sq. on BD + 4. sq. on DA, = sq. on BC + 4. sq. on DA.
Similarly,
2. sq. on BC + 2. sq. on AB = sq. on AC + 4. sq. on EB, and 2. sq. on CA + 2. sq. on CB = sq. on AB + 4. sq. on FC,
∴ three times the sum of the sqs. on AB, BC, CA = 4 times the sum of the sqs. on the medians AD, BE, CF.

Mathematical Course for April.

1. *Arithmetic.* London papers.

2. *Algebra. Hall and Knight, Chapters XV.—XXII.* Involution, Evolution (omitting Cube Root), Factors, H. C. F. and L. C. M. (especially theorems), Fractions. Select the harder Examples, and strive after *facility in factorising.* Those who can should also work at Examples xxix. c; any of these which give special difficulty we shall be glad to answer as Queries next month.

3. *Geometry. Hall and Stevens, Book III. to p.* 212, *with Exercises.*

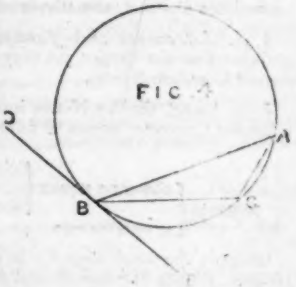
QUERIES.—[N.B. The first two given below are somewhat above Matriculation standards; the solutions are appended, however, as illustrating useful methods.]

(1) Solve $27x^3 + 21x + 8 = 0$.
$(27x^3 + 1) + 7(3x + 1) = 0$.
∴ dividing by $3x + 1$ we have, $3x + 1 = 0$, and
$9x^2 - 3x + 1 + 7 = 0$.
∴ $9x^2 - 3x + 8 = 0$,
and $x = -\frac{1}{3}$ or $\frac{1 \pm \sqrt{-31}}{6}$

(2) Solve $(x + 9)(x - 3)(x - 7)(x + 5) = 1540$.
Re-arranging,
$(x + 9)(x - 7)(x + 5)(x - 3) = 1540$,
∴ $(x^2 + 2x - 63)(x^2 + 2x - 15) = 1540$,
For $x^2 + 2x$ write y, then
$(y - 63)(y - 15) = 1540$,
$y^2 - 78y + 945 = 1540$,
$y^2 - 78y - 595 = 0$,
$(y - 85)\ y + 7) = 0$.
∴ $y = 85$ or -7.
∴ $x^2 + 2x - 85 = 0$ and $x^2 + 2x + 7 = 0$,
whence $x = -1 \pm \sqrt{86}$ or $-1 \pm \sqrt{-6}$.

(3) (*Buchan.*)
Todhunter's definition of "the angle of a segment" is correct. You will see that it is not *rectilineal.* By a *curvilinear angle*, we mean the angle between the tangents to two curved lines at their point of intersection, and by *the angle between a straight line and a curved line* we mean the angle between the former and the tangent to the latter at their point of intersection. Hence by the *angle of the segment* BAC below, is understood the rectilineal angle DBC. If you wish to follow up the subject of tangents to curves, read Newton's Lemmas.

To prove that the angle of a segment of a circle, and the angle in that segment are together equal to two right angles,



FIG

Let BAC be a segment of a circle, and BAC an angle in it.
Draw the tangent DE at pt. B.
Then ∧ BAC = ∧ EBC; (III. 32);
To each add ∧ DBC;
∴ ∧ DBC + ∧ BAC = ∧ DBC + ∧ EBC = 2 rt. ∧s (I. 13).
But, since DB is the tangent at the pt. B,
∴ rectilineal ∧ DBC = the angle of the segment BAC,
∴ etc.

V. MECHANICS.

Wormell, Chapters IX.-XIII. The Lever, Gravitation, Energy, Machines, Units, Friction.

VI. CHEMISTRY.

Kemshead, Chapters VI., XI., XIII., XIV., XV.

VI. HEAT AND LIGHT.

Stewart, Heat, Chapters IX., X. Light, Chapters I.—V.

(FOURTH MONTH.)

I. LATIN.

Notes on April Work.

Cicero, Pro Archia (Dr. Reid), *pp. 5–27. Supplementary Notes. Introduction.* This should be well known. After

reading through the speech, look up the references in these footnotes. § 3 (*Circumstances of the Case*) will require most work. Get up the whole case against Archias, and then, point by point, the counter-pleas. In reading p. 16 it would be well to compile a few notes on legal procedure, for which see any modern book on *Roman Antiquities*, or Gow's *Companion to School Classics*.

§ 1. Read this aloud two or three times, and let every quantity be correct. *Quod sentio, etc.: and I am sensible how little it is; sit:* ind. quest. *In qua me, etc.: in which I do not deny that I have had some little experience. Ratio ac disciplina: knowledge of theory and art. Aliqua:* but above *quae;* see Allen § 314 (c). *Profecta: derived from. Vel:* intensive, with superlative expressions, see Dict. *Fructum: the benefit. Longissime:* strengthens *quoad; as far back as my mind can look over the past. Inde usque: from that point onwards. Hunc mihi principem exstitisse: that it was this man who led me to . . . Haec vox: this voice of mine. Huius:* (Archias) dep. on *hortatu praeceptisque. Id accepimus quo: received the power by which. Prōfecto:* cf. *prōfecta* above. Note the constructions with *abhorreo* and *princeps*.

§ 2. Observe the note on *ne nos quidem. Quod alia, etc.: because there is in this man a certain other . . . but no . . .*

§ 3. *Cui = alicui*, Allen § 314 (c). *Vestrum:* the partitive form. *Me in quaestione, etc.: that I, in a legal trial, . . . when the case is being argued before a praetor . . . should use language of this sort. Hanc veniam: this favour; hanc* is explained by the clause *ut . . . patiamini. Hoc concursu, etc.:* reduce the tone; *in such an assembly of learned gentlemen, before a jury so cultured, and lastly with a praetor to preside such as I see before me.* Account for the mood of *agatur*.

§ 4. *Quod:* subj. of *tribui* and *concedi*. Notice the tenses; *non segregandum (esse), cum sit, . . . adsciscendum fuisse, si non esset. Putetis:* consec. subj. *Condidicit: succeeded in.* Learn the following phrases:—*ex pueris, excessit, se ad scribendi studium contulit, ibi natus est loco nobili.*

§ 5. Notice the construction of *donare. Celebritate famae: celebrity of fame;* abl. of cause with *notus. Quorum alter, etc.: adhibere* will have to be translated twice; *gestas* belongs as much to the first *res* as to the second; notice *posset* (consec. subj.)—*two consuls so remarkable that one of them . . . Sed etiam hoc, etc.: but there is also this sign of his . . . . . that the same family . . . Consuetudine:* social intercourse, conversation.

§ 6. *Quod eum, etc.:* use the passive, *because he was honoured not only by . . .*

§ 7. *Civitas: citizenship. Si tum, etc.: provided that they had . . .*

§ 8. *Si nihil, etc.: if we do nothing but speak on his citizenship and the statute, we say no more than this. Huius indici, etc.: with a view to this trial they have come with affidavits . . . .* Look up *desiderare. Italico bello, etc.: in the Social War when the archives were burnt. Est ridiculum, etc.: it is absurd to make no reply to what we have and ask for what we cannot have. Quas idem, etc.: which moreover, as you state, are often tampered with.*

§ 9. *An domicilium, etc.:* supply the first half of the double question. *Non est professus:* p. 14. *Nam cum, etc: for as the registers of Appius were said to have been carelessly kept, and the corruption of Gabinius before he was accused, and his fate after his condemnation, had destroyed all faith in the registers, Metellus was so careful that . . ;* A. & H. § 133. *Nulla in litura: free from erasure,* see foot of p. 14. *Etenim num, etc.:* for when men were conferring citizenship upon all sorts of nobodies, *I suppose the citizens of Regium, or Locri, or Neapolis, or Tarentum, being accustomed to bestow it upon play-actors, were unwilling to confer it upon this man, gifted as he is with . . .*

§ 11. *Proximis censoribus:* why abl.? *during the enrolment of the last censors. Se gessisse, etc.: reckoned himself a citizen at the time. Quem tu, etc.: who, according to your charge, had no share in the rights of Roman citizens even in his own opinion. Adiit: came into. Si quae:* (neut. pl.) see Dr. Reid's note on *si quid* in § 1.

§ 12. *Suppeditat ubi:* is the note correct here? We do not want for antecedent the name of a person; the reference is to the writings of Archias. *Ex: after;* account for the subjunctives. *Suppetere nobis (id) posse quod:* the subj. *dicamus* makes *quod* indefinite; *that we can be kept supplied with matter for daily pleadings on . . . Doctrina: reading. Pudeat:* jussive. *Si qui . . . abdiderunt:* see *si quid est* in § 1. *Nihil:* obj. of *afferre* and *proferre. Ad communem fructum: to the common good. Me quid pudeat: why should I be ashamed;* deliberative subj. *Ut a nullius tempore, etc.:* freely, *that in the time of peril or the hour of advantage no man has ever known me either drawn away . .*

§ 13. *Quantum:* with partitive gen. *temporum* below; *the time which is allowed to others for prosecuting their own business, attending at the games on holidays; ceteris* is dat. with *conceditur, ludorum* gen. with *dies, celebrandos* agrees with *dies. Quae (oratio) si videtur. Illa quidem, etc.: at any rate I know the fount from which I draw certain principles of the highest import; hauriam:* ind. quest. Learn § 13 in the Latin.

§ 14. *In ea (honestate) persequenda. Quae iacerent, etc.: and all these would be lying in darkness,* Allen § 392 (c). *Quam multas, etc.:* arrange your words carefully here. *Quas ego . . ipsa cogitatione . . animum conformavit: these I always kept before me, and simply by thinking of pre-eminent men I moulded my mind.*

§ 15. *Illi ipsi, etc.:* the order may be followed; *those very men . . were they well-read in these books.*

§ 16. *Ex hoc esse numero: to this number belong. Nihil:* adverbial. *Ceterae (remissiones). Temporum* and the other genitives: *are suitable for. Adversis:* dative; do not mistake the note here; *rebus* is to be understood, but 'the thing is put for the person.' Learn from *quod si* to the end, and notice the additional notes, pp. 81–89.

Latin Course for May.

1. *Allen's Grammar*, §§ *156–183* (Notes on Nouns and Adjectives, Numerals, Pronouns, Terminations, Calendar, Weights and Money, Grammatical Terms), and as much as possible of §§ 300–391.

2. *Allcroft and Haydon*, §§ 206–259.

3. *Allcroft and Haydon, Exercises XI.–XVI.* Written work, omitting XI. B, XII. C, XIII. A, XIV. C, XV. A, XVI. C.

4. *Cicero: pro Archia*, §§ *17–32.* Written translation.

5. *Translation at Sight.* Regular practice.

The January Papers.

I. There were two passages from Horace, A (from Odes III. 11) containing 12 lines, B (from Odes IV. 8) containing 10 lines; there was more than this in two passages for translation at sight, and there were 8 questions 'arising out of' the Horace. The moral is obvious.

II. 5 will show how important is a knowledge of the subject matter of the book prescribed:—

Quote from these Odes, references (*a*) to the Hannibalic War, (*b*) to the wars conducted by Tiberius and Drusus.

II. 6 was a question on Prosody, II. 7 on Geography.

III. A. 8 lines from Tibullus (1. 10. 33).

III. B. 8 lines from Ovid (Tr. 4. 6. 31).

III. C. 2 sentences from Livy 10. 14.

III. D. From Cic., *pro rege Deiotaro* 4.

In *Latin Grammar and Composition* the first five questions were easy. Nos. 1 and 7 are appended.

1. Give the accusative singular and ablative plural of *olus, domus, mas, ros, decus, decor, pecten, lis, cinis, abies.*

olus: olus, oleribus.
domus: domum, domibus.
mas: marem, maribus.
ros: rorem, roribus.
decus: decus, decŏribus.
decor: decŏrem, decŏribus.
pecten: pectinem, pectinibus.
lis: litem, litibus.
cinis: cinerem, cineribus.
abies: abietem, abietibus.

7. Translate into Latin *five* (but not more than *five*) of the following sentences :—

(i) Let us never forget the receiving of a benefit.
(ii) A pine tree grew by the side of the road more than a hundred feet high.
iii) Would that we had either never met or never been separated.
(iv) The centurions drew their swords and prevented the legate from leaving the camp.
(v) Gabinius, a man of greater bravery than prudence, was chosen by the soldiers to be their leader.
(vi) Cicero was assassinated by the soldiers of Antony at the age of sixty-three.
(vii) The soldiers marched forty miles without baggage, and at sunset pitched their camp at the foot of the mountain.
(viii) I call heaven to witness that if it had not been for you I would have slain Catilina with my own hand.

(i) *Beneficii accepti nunquam obliviscamini.*
(ii) *Iuxta viam erat pinus plus pedes centum alta.*
(iii) *Utinam societatem aut nunquam coissemus aut nunquam diremissemus.*
(iv) *Centuriones gladiis destrictis legato obstabant quominus e castris exiret.*
(v) *Gabinium, virum fortiorem quam prudentiorem, milites ducem delegerunt.*
(vi) *Cicero, annos natus sexaginta tres, ab Antoni militibus interfectus est.*
(vii) *Milites, cum quadraginta millia passuum processissent, solis occasu castra sub monte posuerunt.*
(viii) *Deos omnes obtestor me, si per te licuisset, Catilinam mea ipsius manu occisurum fuisse.*

II. GREEK.

Course for May.

1. *Abbott and Mansfield, §§ 163–180.* The 'Principal Parts' are important, §§ 174–180 less so. The Vocabulary at the end affords good practice.

2. *Abbott and Mansfield, Syntax §§ 142–185.*

3. *Xenophon, Anabasis I. Chapters VIII. (from § 14) and IX. Written translation.*

4. *Translation at Sight.* Regular practice.

The January Paper.

Readers of these columns would find themselves, we believe, at a very great advantage in answering these questions. There were four pieces from the *Heracleidae* to be translated, 36 lines in all. The verbal forms to be parsed were—ἄλῐσας, βεβάκαι, γνάσει, δοῦῆσαν, ἴκθυς, ἐξέδραμεν, ἐπαιτιῶ, ἧσμεν, ἡτοιμασμένα, ἶμεν, μαθήσομαι, παράσασθαι, πεπαυθῇς, τρίσηρ, ὑποδεχθείς, χέμενον. The following were given for declension—ἅλλο, μιᾶς, οὕτωσι, τοσήνδε, γεγάς, εἰκάς, τυχάν, παρείς. Question 5 was—Explain and illustrate *Crasis* and *Elision*. Resolve into their component parts—ἀγάν, τἄργος, κἄθ' ἡ, τἀπ' ἐμοῦ.

II. FRENCH.

Course for May.

1. *Breymann's Grammar. Chapters V.* (all the Pronouns), *VI.* (Numerals), *VII.* (Adverbs), *VIII., IX., X. Pronouns* are very important.

2. *Written Translation.* A page or two a week of very careful work.

3. *Rapid Translation.* Make notes of words not known.

4. *Word Lists.* As before.

The January Paper.

Three pieces of prose were given, two only to be translated; there were ten questions on Grammar. Our readers will gather from the following what the questions on verbs were :—

(1) *Venaient:* from *venir, venant, venu,* &c.; *peut:* from *pouvoir,* &c.; *se conduit:* from *se conduire,* &c.; *offert:* from *offrir,* &c.

(2) *Nous embraserons,* we shall set on fire; *nous embrasserons,* we shall embrace; *sied, assied, coud, moud, absout, résout, vainc, peint, point.*

(3) *Je n'aurais pas su, tu n'aurais pas su,* &c.
Je n'aurais pas connu, &c.
Je n'aurais pas dû, &c.
Je ne suis pas né . . . nous ne sommes pas nés, &c.
Je ne suis pas tombé . . . nous ne sommes pas tombés, &c.

(4) *Aller, arriver, partir, sortir,* are conjugated with *être.*

(5) *Nous longeons, vous longez, ils longent; rappelons, rappelez, rappellent; plaçons, placez, placent. Dû, due; redû, redue; crû, crûe; mû, mue.*

(6) *Ne t'en va pas,* and the rest of the imperative; *ne t'endors pas,* &c.; *ne t'enrichis pas,* &c.; *ne t'enfuis pas,* &c.; *ne t'enquiers pas,* &c.

(7) *Que je vaille, que tu vailles,* &c.; *que je prévale,* &c; *va, allons, allez; sache, sachons, sachez; veuille, veuillons, veuillez.*

(8) Special rules for verbs in *ayer, oyer, uyer.*

(10) *Nous riions, vous riiez, qu'ils rient;* so for *prier; agréé, agréée.*

III. ENGLISH.

Notes on April Work.

Mason, §§ 180–341. Master the following points thoroughly :—*Subjunctive Mood* (192), *Infinitive Mood* (194), *Gerund* (200. 3), *Tense System* (205), *Shall* and *Will* (211, 212, 213, 232, 233). *Defective and Anomalous Verbs* and *Relations indicated by Prepositions* require much study.

English Course for *May.*

1. *Mason, §§ 342–499* (Syntax), *601–611* (*Punctuation*), *and Appendix to the end of Grimm's Law.* On pp. 210–212 only the *classes* need be learnt; 215–218 may be omitted; Grimm's Law must be thoroughly done. Supplement from Hewitt and Beach.

2. *Analysis. Mason, §§ 500–600.*

3. *Ransome's History, to 1702, with the Geography relating thereto.*

The January Paper on the English Language.

This was a difficult one; ten questions were to be attempted out of fifteen. Stress is again laid upon the study of words. The following points are some of those to which we had called attention—formation of plurals, irregular comparison, meanings of *one,* second personal pronoun, *shall* and *will,* strong and weak verbs, formation of adverbs. Question 3 was worded as follows :—

> State what you know of the history of every word in the present question, noting any peculiarities in the form or history of each.

14 asked for (*a*) a paraphrase, (*b*) an analysis of a four-line stanza.

IV. MATHEMATICS.

Notes on April Work.

Hall and Knight, XXIX. c.

(9) $x+y+z=0$
$\therefore (x+y+z)(x^2+y^2+z^2-xy-yz-zx)=0$
$\therefore x^3+y^3+z^3-3xyz=0$
$\therefore \underline{x^3+y^3+z^3=3xyz.}$

(11) $(s-a)^2+(s-b)^2+(s-c)^2+s^2$
$=3s^2+a^2+b^2+c^2-2sa-2sb-2sc+s^2$
$=4s^2-2s(a+b+c)+a^2+b^2+c^2$
$=4s^2-2s.\,2s+a^2+b^2+c^2$
$=\underline{a^2+b^2+c^2.}$

(23) If $(a+b)^2+(b+c)^2+(c+d)^2=4(ab+bc+cd)$,
then $a^2+2b^2+2c^2+d^2+2ab+2bc+2cd=4ab+4bc+4cd$,
$a^2+2b^2+2c^2+d^2-2ab-2bc-2cd=0$
$(a-b)^2+(b-c)^2+(c-d)^2=0$
and $a-b=b-c=c-d=0$
$\therefore \underline{a=b=c=d.}$

(27) $(x-a)^2+(y-b)^2+(a^2+b^2-1)(x^2+y^2-1)=0$
$\therefore x^2-2ax+a^2+y^2-2by+b^2+a^2x^2+a^2y^2-a^2+b^2x^2+b^2y^2-b^2-x^2-y^2+1=0$
$\therefore a^2x^2+b^2y^2+1+2axby-2ax-2by+b^2x^2+a^2y^2-2axby=0$
$\therefore (ax+by-1)^2+(bx-ay)^2=0$
$\therefore ax+by-1=0$ and $bx-ay=0$
$\therefore y=\frac{b}{a}x$ and $ax+\frac{b^2x}{a}=1$
$\therefore \underline{x=\frac{a}{a^2+b^2}}$ and $\underline{y=\frac{b}{a^2+b^2}}$

Mathematical Course for May.

1. *Arithmetic.* Theory, and London Papers.

2. *Algebra. Hall and Knight, Chapters XXIII., XXIV., XXV., XXVII., XXVIII., XXXIII., XXXIV.* (Harder Equations and Problems, Quadratics, Harder Factors, Arithmetical and Geometrical Progression). Those who have time should proceed with Chap. XXIX. In working problems cultivate a good *style;* the important part is the preliminary statement.

3. *Geometry. Hall and Stevens, pp. 215-238* (Theorems and examples on Book III., omitting Nos. 35, 36, 37), *and Book IV.*

The January Papers.

In Arithmetic and Algebra there were ten questions, three on Theory. No 7 was—

Simplify—

(i) $\left\{1-\frac{m}{1}+\frac{m(m-1)}{1.2}-\frac{m(m-1)(m-2)}{1.2.3}\right\} \div (m-1)(m-2)(m-3)$

(ii) $\dfrac{x^2+xy+y^2-a(x+y)+a^2}{x+y+a} + \dfrac{x^2-xy+y^2+a(x-y)-a^2}{x-y+a}$

In (1) the expression—

$= \frac{1}{1.2.3}\left\{1.2.3-2.3m+3m(m-1)-m(m-1)(m-2)\right\} \div (m-1)(m-2)(m-3)$

$= \frac{1}{1.2.3}\left\{(m-1)(-6+3m-m(m-2))\right\} \div (m-1)(m-2)(m-3)$

$= \frac{1}{1.2.3}\left\{(m-1)(m-2)(3-m)\right\} \div (m-1)(m-2)(m-3)$

$= -\frac{1}{1.2.3}\left\{(m-1)(m-2)(m-3)\right\} \div (m-1)(m-2(m-3)$

$-\frac{1}{6}$

In (2) the denominator will be $(x+y+a)(x-y+a)$ and the numerator—

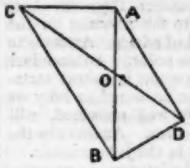
$(x^2+xy+y^2-ax-ay+a^2)\times(x-y+a)$
$+(x^2-xy+y^2+ax-ay-a^2)\times(x+y+a)$
$=(x+a)(x^2+xy+y^2-ax-ay+a^2+x^2-xy+y^2+ax-ay-a^2)+y(x^2-xy+y^2+ax-ay-x^2-xy-y^2+ax+ay-a^2)$
$=(x+a)(2x^2+2y^2-2ay)+y(2ax-2xy-2a^2)$
$=2(x^3+ax^2+ay^2-2a^2y)$

And expression $= \dfrac{2(x^3+ax^2+ay^2-2a^2y)}{(x+y+a)(x-y+a)}$

The Geometry paper was difficult. Only two propositions were set, I. 20 and II. 13. Question 3 puzzled many candidates; the only difficulty is in getting the figure drawn:—

Two straight lines AOB, COD are such that the triangles AOC, BOD are equal in area; prove that AD is parallel to BC.

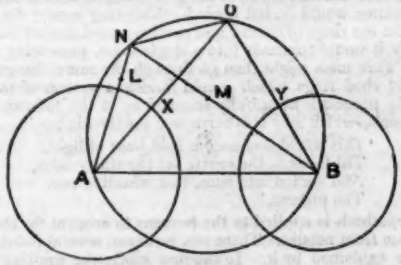
Draw the figure, thus—



Then $\triangle$ AOC = $\triangle$ BOD;
to each add $\triangle$ AOD:
$\therefore \triangle$ ACD = $\triangle$ ABD.
But these are on the same base AD,
$\therefore$ they are between the same parallels (I. 39)
$\therefore$ BC is parallel to AD.

Question 7, involving as it did the finding of a *locus*, was not liked by many candidates. The proof is indicated below:—

Two straight bars AX, BY rotate round the fixed points A, B with equal speed, that is, so that the angles LAX, MBY are always equal, L and M being fixed points. Show that, when they rotate in the same direction, their point of intersection describes a circle.



Produce AL, BM to meet in N.
Let O be the point of intersection.
Now $\angle$ NAO is always equal to $\angle$ NBO,
$\therefore$ A and B are always on a circle of which NO is a chord.
But A, B, and N are fixed;
hence O moves round the circle described through A, B and N.

V. MECHANICS.

Course for May.

Wormell, Hydrostatics. The January paper was difficult. Good diagrams were evidently desired by the examiners, for two questions contained the words *draw to scale*, another asked for a figure and nothing more, and at the head of the paper appeared the caution, *Diagrams should be carefully drawn.*

VI. CHEMISTRY.

Kemshead. Chapters XVI.-XIX.

VI. HEAT AND LIGHT.

Stewart. Light, Chapters VI.-IX.

NOTES ON ADVANCED AND HONOURS PHYSIOGRAPHY.

BY R. A. GREGORY, F.R.A.S.

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THE majority of the notes given this month refer to recent researches, and should be particularly marked by Honours students. All the notes should be carefully digested, for each contains information upon which questions are likely to be asked. After reading through the notes and revising previous work, the student is recommended to answer the test paper given, this being the one set at the Training College examination in December 1891. References to the subjects of the questions are given at the end of the paper, so that the accuracy of the answers can be tested. It is a common occurrence for questions set at the Training College examination to be repeated in the May paper. On this account, the Advanced and Honours questions of December 1892 are here answered. Attention is particularly drawn to the remarks on the formation of schistose rocks. Finally, a word of advice. Answers to the Advanced paper should be brief and to the point. An examiner is never deceived by mere verbiage; what he wants is a short statement of fact. Honours questions should be answered as fully as possible. Three and a half questions, fairly well answered, will ensure a pass, and four fully answered a first class. Answers to the Advanced and Honours questions will appear in the June number.

The Nebular Hypothesis.—Kant and Swedenburg made speculations as to the genesis of the solar system, and Laplace developed the theory mathematically. It is supposed that ages ago the sun existed in the form of a nebula, extending probably beyond the orbit of Neptune. The solar nebula was supposed to consist of incandescent gas. The shape of such a mass of glowing gas would be spherical, and a motion of rotation would be set up in it. As the nebula cooled, it would contract. The rotational velocity would thereby be increased, and eventually the centrifugal tendency at the equator would become equal to the gravitational attraction, and a ring of matter would be left behind. This ring would for a time behave like the rings of Saturn and revolve round the central body, but finally it would condense into a single mass, possessing similar motion. This mass might then go through the same changes as its parent, and shed rings which would furnish a system of satellites. The whole process is beautifully summed up in the following lines of Tennyson's, which may also serve as a mnemonic:—

> 'This world was once a fluid haze of light,
> Till towards the centre set the starry tides,
> And eddied into suns, that wheeling cast
> The planets.'

This hypothesis is applied to the heavens to account for the evolution of stars from nebulæ. There are, however, several points which cannot be explained by it. In the first place, the original nebula very probably consisted of an infinite number of cold, solid particles jostling one another like gnats on a summer evening, and thus provoking sufficient heat to vapourise some of the constituents. Prof. George Darwin has proved that, from a dynamical point of view, a swarm of solid particles would behave like a mass of gas. The spectroscopic evidence in favour of this 'meteoritic hypothesis'—which can be considered as an extension of the nebular hypothesis—has been referred to in previous notes.

Tidal Evolution.—Prof. G. H. Darwin has shown mathematically that at one time the earth and moon formed a single molten mass, rotating in a period of from two to four hours, and revolving round the sun in a period not much shorter than our present year. Owing to rotational instability, or tidal action set up by the sun, the fluid mass separated into two parts, the smaller to form the moon and the larger the earth. The two bodies were then in contact, and each exerted a tidal action upon the other, while the sun raised tides in both. At that time the moon's period of revolution was slightly longer than the earth's period of rotation, in other words, the month was slightly longer than the day. Tracing the history from that time, Prof. Darwin remarks: 'The axial rotation of the moon is retarded by the attraction of the earth on the tides raised in the moon, and this retardation takes place at a far greater rate than the similar retardation of the earth's rotation. As soon as the moon rotates round her axis with twice the angular velocity with which she revolves in her orbit, the position of her axis of rotation (parallel with the earth's axis) becomes dynamically unstable. The obliquity of the lunar equator to the plane of the orbit increases, attains a maximum, and then diminishes. Meanwhile the lunar axial rotation is being reduced towards identity with the orbital motion.'

'Finally her equator is nearly coincident with the plane of her orbit, and the attraction of the earth on a tide which degenerates into a permanent ellipticity of the lunar equator causes her always to show the same face to the earth.'

The course of changes brought about by these mutual actions from the birth of the moon until now is tabulated below, and summed up as follows:—(1) The length of the day has increased from 5·6 hours to 23·93 hours. (2) The moon's period of revolution has increased from 0·23 days to 27·32 days. (3) The number of days in a month increased from 1 to a maximum of 28·83, and then decreased to 27·40 at the present time. (4) The moon's distance has increased from 1·5 the radius of the earth to 60·4 times the radius.

Number of millions of years ago.	Length of sidereal day, in mean solar hours.	Length of moon's sidereal period, in mean solar days.	Number of days in a month.	Distance of moon, in earth's mean radii.
... ..	5·60	0·23	1·00	1·5
56·81	6·75	1·58	5·62	9·0
56·80	7·83	3·59	11·01	15·6
56·60	9·92	8·17	19·77	27·0
46·30	15·50	18·62	28·83	46·8
Present time.	23·93	27·32	27·40	60·4

The number of days in a month must go on decreasing until a month of one day is reached. This great day will be about equal to fifty-seven of our days. 'After the moon's orbital motion has been reduced to identity with that of the earth's rotation, solar tidal friction will further reduce the earth's angular velocity, the tidal reaction on the moon will be reversed, and the moon's orbital velocity will increase, and her distance from the earth will diminish.' We shall then have a condition of things such as obtains to Mars, in which a satellite revolves round the primary in less time than the planet itself takes to perform a rotation.

The Opposition of Mars in 1892.—The final results of observations of Mars made under Prof. Pickering's direction at Arequipa last year are summarised in the December number of *Astronomy and Astro-Physics* as follows:—(1) The polar caps are clearly distinct in appearance from the cloud formations, and are not to be confounded with them. (2) Clouds undoubtedly exist upon the planet, differing, however, in some respects from those upon the earth, chiefly as regards their density and whiteness. (3) There are two permanently dark regions upon the planet, which under favourable circumstances appear blue, and are presumably due to water. (4) Certain other portions of the surface of the planet are undoubtedly subject to gradual changes of colour, not to be explained by clouds. (5) Excepting the two very dark regions referred to above, all of the shaded regions upon the planet have at times a greenish tint. At other times they appear absolutely colourless. Clearly marked green regions are sometimes seen near the poles. (6) Numerous so-called canals exist upon the planet, substantially as drawn by Prof. Schiaparelli. Some of them are only a few miles in breadth. No striking instances of duplication have been seen at this opposition. (7) Through the shaded regions run certain curved branching dark lines. These are too wide for rivers, but may indicate their courses. (8) Scattered over the surface of the planet, chiefly on the side opposite to the two seas, we have found a large number of minute black points. They occur almost without exception at the junctions of the canals with one another and with the shaded portions of the planet. They range from thirty to one hundred miles in diameter, and in some cases are smaller than the canals in which they are situated. Over forty of them have been discovered, and for convenience we have termed them lakes.

These conclusions contain practically all the information gained by observations of Mars in 1892. The student who digests them should be able to earn full marks on a question relating to recent researches on the planet's physical appearance.

The Planet Venus.—Some important observations of Venus have recently been made by Prof. Tronvelot, and form the subject of an illustrated article in *Nature*, September 15, 1892. The chief results are summarised here, and ought to be 'made a note of' by both Advanced and Honours students. The surface markings of Venus can be classfied into (1) Snow-caps at the poles of the planet; (2) whitish spots of a more or less rounded form; (3) large greyish spots or bands. The snow-caps resemble those which are a feature of the surface of Mars. 'They have the form of a uniform white segment of a circle, which, when seen edgeways, appear as simple lines; they are always exactly 180° apart; sometimes only one is seen because the other is not lighted up by the sun; they are of a permanent nature, their disappearances being due not to their annihilation, but simply to the fact that they cannot be seen when receiving no light upon them. One main feature in which they differ from the spots on Mars is that they neither increase nor decrease with the seasons, at any rate to a sufficient extent to be sensibly noticed.'

It is hardly necessary to remind students that Venus passes through a cycle of changes or phases, like the moon. The line of separation between the illuminated and the dark parts in either case is called the 'terminator.' In order to determine whether any irregularities exist on the surface of the Venus, in other words, whether there are mountains and valleys on the earth's twin-sister, Prof. Tronvelot has examined the terminator from time to time. If the surface of the planet were perfectly spherical, the terminator would always be an unbroken curve. Observations show that this is not the case. The terminator has frequently been seen notched and wavy, thus indicating that all parts of the surface have not the same level. The white spots referred to above appear to be higher than the surrounding regions, and the greyish spots appear to be lower than parts near them. In fact, the former represent mountains of Venus and the latter valleys.

The spots and markings have been used to determine the period of the planet's rotation, and from observations of them, the period deduced is rather more than 24 hours. Prof. Tronvelot combats Schiaparelli's view that the rotation period of Venus is the same as the period of revolution, viz., 225 days, and shows that all the features observed on the planet's surface tell against it. It seems very probable, therefore, that though the rotation and revolution periods of Mercury may be identical, the identity does not hold good for Venus.

Spectroscopic Double Stars.—In 1889 Prof. Pickering discovered that the dark lines in the spectrum of ζ Ursæ Majoris were doubled at intervals of 52 days. The explanation of this periodical doubling is that the star really consists of two bodies of about equal size, so close to one another that no telescope can show their duplex character. If the component stars were at rest, their two spectra would overlap, but they are in revolution round the common centre of gravity in an orbit which can be likened to a hoop looked at edgeways. When one star is rushing towards us the other is running away from us. The set of spectrum-lines belonging to the former body are therefore shifted slightly towards the blue end of the spectrum, that is, increased in pitch, while those of the latter experience a shift towards the red end, or are lowered in pitch. Hence, instead of overlapping, the two sets of lines are separated by a slight amount when the above conditions obtain. When, however, the two stars are moving *across* the line of sight, that is, neither increasing nor decreasing their distance from the earth, there is no decrease or increase of pitch, and the two spectra overlap. Twice, then, in a revolution, are the spectrum-lines single, and twice are they duplicated. Fifty-two days elapse between two successive maximum separations of the lines, hence the period of revolution is twice this interval, that is, 104 days. Measurement of the amount of separation shows that the relative velocity of the components is about 100 miles per second.

A similar periodic doubling has been found in the spectrum of β Aurigæ, the intervals in this case being only two days, and therefore the period of revolution is about four days. The relative velocity is about 140 miles per second, that is, each star moves at the rates of seventy miles per second.

Future investigations will very probably reveal a large number of these close revolving suns.

The System of Algol.—Algol is a well-known variable star. For about two-and-a-half days the star is of the second magnitude. It then loses five-sixths of its light in four hours, shines like a star of the fourth magnitude for a quarter of an hour, and then regains its former brilliancy in another four hours. For a long time astronomers have believed that the variability of Algol is caused by the revolution of a dark body round it, and periodically eclipsing its light. Vogel, of Potsdam, has proved this theory to be the correct one. Spectroscopic observations show that Algol alternately moves towards and away from the earth in a period coincident with that of its variation in light. Seventeen hours before a minimum of light—when the dark companion is rushing forward to obstruct the light of Algol—the star itself is being swung back. In a similar manner, after the dark companion has passed in front of the star, it moves away and causes Algol, which is situated on the opposite side of the common centre of gravity, to swing forward. The velocity of approach and recession indicated by the shift of position of the spectrum lines, is about twenty-six miles per second.

In the case of the Algol system, the orbit happens to lie nearly edgeways with respect to the earth. If the orbit were inclined so that the dark companion pass above or below the bright star when on the earthward side of it, evidently no eclipse of the star's light would occur. Nevertheless, such a star would be swung backwards and forwards by the dark companion. Spica appears to be a star of this character—a body under the influence of an unseen world. It swings backwards and forwards in a period of four days, each component of the system moving at the rate of about fifty-six miles per second.

The Formation of Dew.—Until recent years meteorologists have held that dew is produced by the condensation of aqueous vapour contained in the atmosphere. Researches by Mr. John Aitken and the Hon. R. Russell have shown, however, that this theory is inconsistent with facts of observation. The amount of dew frequently deposited is far in excess of the moisture that could be held in the surrounding air. This therefore led to the idea that dew is mostly formed by moisture derived from the ground and from vegetation. The experiments indicating that this is the case are thus summarised by the Hon. R. Russell in his 'Observations on Dew and Frost.'

(1.) A large quantity of dew was invariably found on clear nights in the interior of closed vessels over grass and sand.

(2.) Very little or no dew was found in the interior of vessels inverted over plates on the ground.

(3.) More dew was found on the lower side of a square, slightly raised, china plate over grass or sand than on the lower side of a similar plate placed upon the first.

(4.) The lower sides of stones, slates, and paper on grass or sand, were much more dewed than the upper sides. The flat wooden back of the minimum thermometer on clear evenings when lying on earth, sand or grass, was almost invariably wet before the upper surface.

(5.) The lower side of plates of glass, one or two inches above grass, were as much or more bedewed than the upper sides.

(6.) Leaves of bushes, leaves lying on the ground, and blades of grass were about equally bedewed on both sides.

(7.) The interior of closed vessels inverted on the grass and covered with two other inverted vessels of badly-conducting substance were thickly bedewed, and the grass in the three circular enclosures also thickly bedewed.

(8.) The deposit of dew on the interior of closed vessels inverted over dry garden earth was much less than over sand or turf, although the powdery condition of the earth in the morning showed that no deposit from the air had taken place on its surface during the night.

(9.) Usually a greater amount of dew was deposited in the interior of vessels when the earth was moist at a little depth below the surface than when the earth was at its driest.

(10.) The temperature of the space under a glass plate or other object suspended near the surface of the ground was higher than that of the upper surface of the object, and, nevertheless, a cloudy film was produced first on the lower surface.

(11.) A large difference was often observed between the quantity of dew deposited in the interior of a vessel inclosing a plant, and the quantity of an empty vessel.

These facts prove indubitably that a large amount of dew is derived from vapour exhaled from the earth and plants.

The effect of grass in promoting dew-formation is said to be owing to the following:—(1) Its radiative power cooling its surface below the dew point. (2) The consequent cooling of the stratum of air in and over the grass to a point much below that of the air a few feet higher. (3) The obstruction offered by the grass to any light air or breeze on a nearly calm night, and the consequent settling down, without much disturbance, of a cold heavy stratum. (4) The prevention by the grassy covering of the drying-up process by sun and wind which takes place on bare ground, and to the moist earth which therefore exists under grass near the surface even in dry weather. (5) The exhalation of vapour from the grass.

Some remarks on this subject will also be found in the Science Notes of the September Number of THE PRACTICAL TEACHER.

The Formation of Rock-Basins.—A number of geologists, following Sir A. Ramsay, affirm that many of the rock-basins occupied by lakes have been ground out by glacial ice accumulated over them during the ice-age. An opposing school hold the view that the action of ice is entirely insufficient to produce lake-basins of this character, and that they have been formed by earth-movements. Mr. A. R. Wallace, in *Nature*, March 9th, adduces some new arguments in favour of the former view. In the first place, Alpine or mountain lakes are only found in districts in which there is clear evidence of glaciation. Mountain-ranges which do not exhibit signs of having been covered with an ice-sheet do not contain rock-basin lakes. Fiords show exactly the same distribution; they occur only in glaciated countries. If the earth-movement theory is accepted, it is necessary to assume that the movements were confined to glaciated regions, which is quite unthinkable. Another point which has not been satisfactorily explained by the earth-movement advocates is the prevalence of mountain lakes in tertiary or secondary rocks, that is the rocks which would be most easily denuded or ground away. This can only be accounted for by supposing that all the elevations and depressions occurred at about the same geological time as well as being restricted within the limits of glaciation. Prof. Bonney, in a recent lecture at the Royal Geographical Society, cites the facts which oppose the view that glaciers are excavators (*Nature*, March 30th). It is confessed that lakes abound in regions subject to glaciation, but many of them are

formed by the damming of valleys by moraines and do not lie in hollows scooped out of solid rock. Observations of the action of Alpine glaciers indicate that the ice acts like a rasp rather than as a chisel; it modifies but does not revolutionise. 'Valleys appear to be much older than the Ice Age,' says Prof. Bonney, 'and to have been but little modified during the period of maximum extension of the glaciers.'

As an objection to the glacial excavation theory it is pointed out that the lakes of Constance, Geneva, Como, Maggiore, etc., are comparatively near to the lower limits of the great ice sheets, and so would be covered for a relatively short time. All of them are many miles from the ends of the existing glaciers, yet we are asked to admit that a rock-basin in depth sometimes exceeding 1,000 feet and generally more than 500, has been scooped out in a time much shorter than that which has proved insufficient for the obliteration of the original features of the upper valleys, or for the deepening of their beds by more than a few yards at most. Prof. Bonney therefore concludes that 'while we may venture to ascribe to glaciers certain tarns and rock-basins in situations exceptionally favourable, we cannot assign to their agency either the greater Alpine lakes, or any other important lakes in regions which were overflowed by the ice only during the period when it attained to an abnormal development.' To which it is replied by glacial advocates, that conclusions drawn from observations of such mediocre glaciers as those of the Alps are not worth consideration. Let the observers go to 'Greenland's icy mountains,' and see the mighty rivers of ice at work there. They will then have no difficulty in understanding the formation of rock-basins by glacial action.

The Development of Coast Lines.—In a number of places, beaches and sea-worn caves are found at a considerable distance above the high-water mark of the neighbouring sea. For nearly a century the view has been held that such beaches and caves have been 'raised' above sea-level by internal disturbances. But a new school of geologists has arisen under the leadership of Prof. Suess, of Vienna, and the old idea is now revived, that the beaches and caves in question are left high and dry by the retreat of the sea, and do not represent results of upheaval; in other words, the water is said to leave the land, and not *vice versâ*. Changes in coast-lines would thus be the result of secular movements of the sea. It must be conceded, however, by all geologists, that the cooling of the earth has caused distortions in the crust, hence there is little doubt that the general trend of coast-lines must have been changed by movements of the lithosphere. Prof. James Geikie has stated the cases of the old and new geology as follows: 'Geologists have maintained that the mysterious subterranean forces have affected the crust in different ways. Mountain ranges, they conceive, are ridged up by tangential thrusts and compression, while vast continental areas slowly rise and fall, with little or no disturbance of the strata. From this point of view it is the lithosphere which is unstable, all changes in the relative level of land and sea being due to crustal movements. Of late years, however, Trantschold and others have begun to doubt whether this theory is wholly true, and to maintain that the sea-level may have changed without reference to movements of the lithosphere. Thus Hilber has suggested that sinking of the sea-level may be due, in part at least, to absorption, while Schmick believes that the apparent elevation and depression of continental areas are really the results of grand secular movements of the ocean. The sea, according to him, periodically attains a high level in each hemisphere alternately, the waters being at present heaped up in the southern hemisphere. Prof. Suess, again, believing that in equatorial regions the sea is, upon the whole, gaining upon the land, while in other latitudes the reverse would appear to be the case, points out that this is in harmony with his view of a periodical flux and reflux of the ocean between the equator and the poles. He thinks that we have no evidence of any vertical elevation affecting wide areas, and that the only movements of elevation that take place are those by which mountains are upheaved. The broad invasions and transgressions of the continental area by the sea, which we know have occurred again and again, are attributed by him to secular movements of the hydrosphere itself.' For further information, see *Nature*, August 11, 1892, p. 348. In connection with this subject see also the next note.

The Permanence of Ocean-Basins.—The doctrine of the permanence of the great ocean-basins, arrived at from independent considerations by Dana, Darwin, Geikie, Wallace and others, is an assertion that those areas of the earth's surface now containing the greatest ocean-depths (areas whose boundaries roughly correspond with submarine contour of 1,000 fathoms) have from the earliest geological times, been areas of depression: the continental areas (including the shallower seas) being areas of relative elevation.

The principal considerations which have led to this view are as follows:—

(1.) *A priori* considerations on the movements of the earth's crust and the origin of ocean-basins.

(2.) The absence, among the stratified rocks forming continental masses, of deposits similar to those now forming in the truly oceanic areas.

(3.) The character of the rocks composing oceanic islands (*i.e.* islands within the oceanic areas as defined above). In such islands there is a complete absence both of sedimentary rocks, such as would be derived from the waste of a continent, and of plutonic rocks which can only be formed under the pressure of thick and extensive rock-masses overlying.

(4.) Various considerations as to the geographical distribution of animals and plants.

The objections to these arguments may be summarized thus:—

(1.) *A priori* argument is of the nature of reasoning in a circle, in the present state of knowledge. Before trustworthy conclusions can be drawn, much more information is required on the following points:—

(*a.*) The variability in the actual quantity of water covering the depressions in the earth's crust. The further study of volcanic action may afford information as to whether the enormous amount of water brought to the surface in every volcanic eruption is or is not an actual addition to the bulk of surface-water.

(*b*) The earth-foldings which produce mountain chains—whether they are or are not confined to the continental areas, as is asserted by some of the upholders of the permanence theory.

(*c*) The exact nature of the movements known as 'secular upheaval and depression,' and the extent to which new ocean-basins may have been formed by regional sinkings.

(2.) The deposits formed in shallow water areas are far thicker than the deep-sea deposits formed in an equal time: hence the latter may easily be overlooked, while the former are recognized, and so a formation may be described as entirely shallow water which really includes deep-sea beds.

Nevertheless, there are deposits which may well be compared, both lithologically and palæontologically, with the abysmal deposits of the present time: such are the Radiolarian cherts of various ages, comparable to modern Radiolarian ooze, and associated with other rocks of abysmal character; and the chalk, comparable to Globigerina ooze. Certain of the Miocene ('Langhian') beds of Italy, and the late tertiary beds of the West Indies, are strictly comparable to modern deep-sea oozes.

(3.) New Zealand and New Caledonia, though surrounded by deep sea, contain Palæozoic and Mesozoic sedimentary rocks; the Seychelles, similarly situated, consist of gneiss. These islands are consequently denied the right to be called 'oceanic'; but even as regards the unquestionably oceanic islands, the evidence is merely negative.

(4.) Many facts of geographical and geological distribution are against the permanence-view. Thus the similarity between the late tertiary corals and echinoids of Europe and the West Indian region can only be accounted for by a transatlantic shallow-water (or even land-)connection.

Photographs of Lightning.—Three kinds of lightning have usually been distinguished, viz., forked or crooked lightning; sheet, heat, or summer lightning and a rare form known as ball or globular lightning. Photographs of lightning flashes have shown, however, that many ideas as to the character of lightning flashes are erroneous. In the first place the zigzag dove-tail form in which lightning is generally represented by artists does not exist in reality. Not a single instance of the artists' lightning-flashes is found upon the photographs that have been taken. The ordinary flash appears upon the pictures as a stream of light following a sinuous or wavy course, and precisely similar in character to the spark of an electrical machine. Other kinds are classified as follows:—

(1.) Branched or ramified lightning, having much the same appearance as a map of a river into which a number of tributaries are flowing. To obtain an effect of this character, the terminals of the electrical machine must be separated so that the spark only just passes between them. Such flashes indicate that the discharge is incomplete.

(2.) Beaded lightning. In this kind a number of bright spots appear upon the flash. It can be produced experimentally by the discharge of a large quantity of electricity, hence it is probably produced when the quantity of electricity passing is much greater than in ordinary flashes.

(3.) Meandering or knotted lightning. In flashes of this kind, the electricity appears to have taken very circuitous paths, the stream of light sometimes having the form of an irregular loop or knot. The effect is probably due to an optical illusion, for the different parts of such loops or knots may be several miles apart, and only appear close together because they are in nearly the same line of sight.

(4.) Ribbon lightning. A large number of photographs show flashes of a flat or ribbon-like appearance. It is believed that this form is generally produced by a movement of the camera while the flash was being photographed. Two or more flashes frequently run along the same path in rapid succession, and the impressions of these upon slightly different parts of the sensitive plate would cause a ribbon-like picture to be obtained. Even when the camera is absolutely steady, the effect is often found to be due to the light falling slantingly upon it, and being reflected from the surfaces of the lens.

(5.) Dark lightning. Lightning flashes sometimes appear black instead of white upon the photographic picture. This is found to be purely a chemical effect. If the lens of a camera is covered up as soon as a lightning flash is photographed, the flash has the usual white appearance upon the resulting picture; if, however, a feeble, diffused light act upon the plate after the flash has been photographed, but before development, the result is a dark flash. The effect has been produced experimentally.

TEST PAPER.

Second Stage, or Advanced Examination.

Instructions.

You are permitted to *attempt* only *five* questions, three of which must be taken from one Series, and two from the other.

The value attached to each question is the same.

Series I.

(1.) What instruments are needed in a magnetic observatory? State the objects of the employment of each.

(2.) State the differences in (*a*) the spectra, and (*b*) the nature of stars and nebulæ.

(3.) What is the constant of aberration? How has it been determined?

(4.) What causes have been suggested for the variability of the light of stars?

Series II.

(5.) Name the corresponding plutonic and volcanic rocks which are of (*a*) acid, (*b*) intermediate, and (*c*) basic composition, stating the minerals which are usually present in each.

(6.) Name four different kinds of organisms whose remains go to form limestones, giving examples of either ancient or modern limestones composed of each of these organisms.

(7.) Explain the conditions which give rise to—

(*a*) Abundant rainfall.

(*b*) Great drought.

And gave examples of districts characterised by—

(*c*) Excessive rainfall.

(*d*) Absence of rain.

(8.) What do you know concerning the waters of the deepest parts of the ocean as regards—

(*a*) Temperature.

(*b*) Density.

(*c*) Composition.

(*d*) The organisms living in them.

References to Answers.

(1.) (*a*) See Elementary Physiography, pp. 383–7, and the answers to the Honours Questions, 1892, in this number.

(2.) See Notes on *Spectra of Celestial Bodies*, February; *The Meteoritic Hypothesis*, March; and conclusions from *Photographs of Stellar Spectra* in the same number.

(3.) See Elementary Physiography, pp. 129–31.

(4.) See Note on *Explanation of Variability*, p. 465, in February number.

(5.) See Elementary Physiography, pp. 182–3.

(6.) See Elementary Physiography, pp. 194, 202–4.

(7.) See Elementary Physiography (*a*) p. 313, (*b*) pp. 314–5, (*c*) 317, (*d*) pp. 317–9.

(8.) See Elementary Physiography, (*a*) pp. 271–4, (*b*) pp. 257–8, (*c*) pp. 254, 256, (*d*) p. 264.

Honours Examination.

You are permitted to attempt all or any of the questions.

The value attached to each question is the same.

(1.) What is known of the changes which comets undergo in their journey round the sun?

(2.) Describe the spectra of—

(*a*) Solar prominences.

(*b*) Solar spots.

(3.) What is known of the difference in the nature and rate of movement of glaciers in Arctic and Alpine regions respectively?

(4.) State what you know concerning the nature and origin of flint and chert.

(5.) Give an account of recent researches in connection with *one* of the following subjects:—

(*a*) The results of tidal action on the movements of the earth and moon.

(*b*) The nature of lightning flashes, especially as illustrated by photography.

References to Answers.

(1.) See Note on *Changes in a Comet*, p. 572, April.

(2.) See Notes on *Solar Prominences* and *Sun-spot Spectra*, p. 498, March.

(3.) See *Physical Geography Questions*, p. 573, April. Elementary Physiography, revised edition, pp. 349–50. Arctic glaciers are larger than Alpine; they flow much more rapidly, reach to a much lower level, many only breaking off at the sea to form icebergs, and their enormous size gives them considerable grinding power, Alpine glaciers carry a larger proportion of moraine matter than Arctic ones, and are the remnants of glaciers which once reached to sea level.

(4.) See Elementary Physiography, pp. 173 and 190. Flint is silica first secreted from sea water by various organisms, and subsequently increased by chemical deposition. Chert is an impure calcareous variety of flint.

(5.) (*a*) See Note on *Tidal Evolution* in this number.

(*b*) See Note on *Photography of Lightning* in this number.

QUESTIONS AND ANSWERS TO THE ADVANCED AND HONOURS QUESTIONS IN PHYSIOGRAPHY SET AT THE TRAINING COLLEGE EXAMINATION IN DECEMBER 1892.

Second Stage, or Advanced Examination.

Series I.

(1.) Describe the method of determining the position of a heavenly body by means of the transit circle.

The co-ordinates which have to be determined are Right Ascension and Declination. To find the former, the sidereal time at which the body crosses the central wire of the transit circle is noted. This can be done by the 'eye and ear' method, or better, by using a 'chronograph.' The result is the object's Right Ascension. The instrument is adjusted so that its vernier is in front of the division 90° on the graduated circles when the instrument is pointed to the celestial poles, and 0° when directed towards the celestial equator. Declination is therefore determined by taking the 'circle reading' when the object is on the meridian. It is north if above the celestial equator, and south if below.

(2.) Give the elements of a planet's orbit.

(*a*) Mean Distance, (*b*) Eccentricity, (*c*) Inclination, (*d*) Longitude of Ascending Node, (*e*) Longitude of Perihelion, (*f*) Mean Longitude at some Epoch.

(3.) What is a sun spot? What changes take place in the solar latitudes at which they occur at different times?

(*a*) A depression or cavity in the sun's photosphere, filled with comparatively cool matter descending from higher to lower levels. It is probably analogous to a cyclone on the earth. (*b*) After a minimum of activity, spots break out in high solar latitudes. There is then a steady decrease of the mean latitudes in which spots occur until the end of the cycle, that is for nearly twelve years, when the spots again begin to appear in high latitudes. In other words, the favourite walks of spots descend towards the solar equator in passing from one minimum to the next.

(4.) State the groups into which stars have been arranged according to their spectra.

(The word *groups* should be noticed, for it signifies that the meteoritic classification is required. Secchi divided spectra in *Types*; Vogel into *Classes*; Lockyer into *Groups* as follows):—

Group I. Nebulæ, and bright line stars.

Group II. Stars showing spectra made up of carbon fluting radiation, and absorption of the flutings of some metals, *e.g.*, α Orionis.

Group III. Fluting absorption replaced by line absorption, *e.g.*, α Tauri.

Group IV. Hydrogen absorption predominant. Highest temperature, *e.g.*, α Andromedæ.

Group V. Absorption of Iron predominant, *e.g.*, Capella and the Sun.

Group VI. Carbon absorption predominant, *e.g.*, 152 Schjellerup.

Group VII. Extinction of luminosity, *e.g.*, Earth and Moon.

Series II.

(5.) What are the minerals usually present in granite and basalt respectively? State what you know of the chemical composition of each of these minerals.

GRANITE.

Quartz.	*Felspar.*	*Mica.*
Silica { Silicon. Oxygen.	Silica { Silicon. Oxygen.	Silica { Silicon. Oxygen.
	Alumina { Aluminium. Oxygen.	Alumina { Aluminium. Oxygen.
	Potash { Potassium. Oxygen.	Potash { Potassium. Oxygen.
		Magnesia { Magnesium. Oxygen.
		Iron Oxide { Iron. Oxygen.

In basalt the usual minerals are triclinic felspar, angite, magnetite, limonite, and olivine. The felspar is chemically similar to that shown above, with the potash replaced by soda (NaO), or lime (CaO). Angite is a silicate of calcium, magnesium, and iron; magnetite is an oxide of iron; limonite is a hydrated iron oxide; and olivine is a silicate of magnesium and iron.

(6.) Explain the chemical changes which take place in the conversion of the remains of plants into coal.

	Wood.	Peat.	Lignite.	Common Coal.	Anthracite.
Carbon . .	50	56	68	86	93
Hydrogen .	6	6	5	5	3
Oxygen & Nitrogen .	44	38	27	9	4
	100	100	100	100	100

Thus the percentage proportion of gaseous materials diminishes from wood to anthracite, while the proportion of carbon increases. Heat and pressure is the cause of these changes.

(7.) What is meant by the 'dew-point'? Explain the construction and mode of use of the dew-print hygrometer.

(*a*) The temperature at which the vapour-tension of water is the same as the tension of the water-vapour in the air; or to put it another way, the temperature at which the vapour present at any time is just sufficient to saturate the air.

(*b*) Daniell's hygrometer is the simplest means for the direct determination of the dew-point (Fig. 1). The bulb A is covered with linen, and B is made of black glass. Inside the stem of B is a small thermometer partly immersed in ether. Ether is dropped upon A; the ether vapour inside is thereby condensed, and evaporation goes on from the liquid in B. Evaporation causes a lowering of temperature, and by continuing the operation, B is eventually cooled down, until a film of moisture is deposited upon its surface. The temperature then indicated by the enclosed thermometer is the *dew-point*. The dew-point can also be indirectly obtained from observations with the *wet and dry bulb hygrometer*.

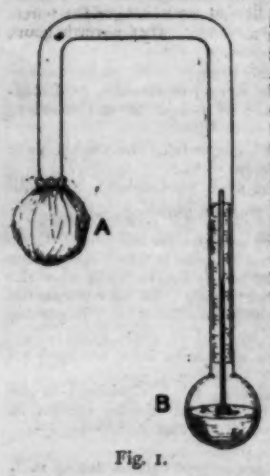

Fig. 1.

(8.) What are the chief causes which determine the character and direction of the great ocean currents?

The character of an ocean current is determined by the temperature of the region from which the water flows. Thus the great equatorial current is a broad stream of warm water flowing in a westward direction, and carrying warmth to the east coasts of South America and Africa, while cold currents flow from the Arctic Ocean into the Atlantic, and from the Antarctic into the Pacific. There are three land masses to deflect the equatorial current, hence, remembering that currents moving from the equator are deviated eastward, but westward if towards the equator, we get six great systems of oceanic circulation, viz., three vortices revolving in the same direction as watch-hands in the northern hemisphere, and three revolving in the opposite direction in the southern hemisphere. See Elementary Physiography, p. 275, 277.

HONOURS EXAMINATION.

(1.) Describe a magnetic observatory.

The instruments of a magnetic observatory are of two kinds:—(1) Instruments for the accurate determination of magnetic elements. (2) Self-recording instruments for indicating *differences* in the intensities of magnetic elements. The former kind include—(*a*) A Declinometer for measuring magnetic declination. (*b*) A Dip-circle for measuring the angle of dip. (*c*) Horizontal-force or Kew magnetometer. The self-recording or differential magnetometers include—(*a*) A declinometer. This consists of a magnet suspended by a torsionless thread. Rigidly attached to the under side, and perpendicular to the magnet, is a semicircular mirror, which, when the magnet is at rest, lies in the same plane as another semicircular unconnected mirror below it (Fig. 2). (*b*) Horizontal force magnetometer. This consists of a magnet suspended in a direction at right angles to the meridian by means of two fine wires. To keep the magnet in this position, the wires are given a slight twist by means of the clamp at their upper ends. The magnet is thus being pulled towards the magnetic meridian by the earth's horizontal force, and the threads prevent it from obeying the behest. The force exerted by the threads can be considered to be constant, hence any variation in the horizontal force causes the magnet to twist the threads either more or less. A semicircular mirror is attached to the under side of the magnet as in the declinometer, and a similar one, not connected with the magnet, is fixed below (Fig. 3). (*c*) Vertical-force magnetometer. In this a magnet is balanced on a knife-edge. Any variation in the intensity of the vertical force disturbs the balance. A beam of light impinges upon the fixed mirrors and those attached to each magnet. It is reflected as two points of light to a revolving drum covered with a sensitised film. The points from the fixed mirrors trace unbroken lines on the film, those from the movable halves fluctuate to and fro according to the variations in the positions of the magnets, and so produce zigzag lines.

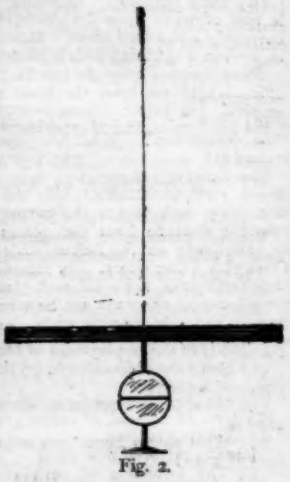
Fig. 2.

(2) State the modern methods by which the distances of stars are determined.

The *absolute* or *transit-circle* method of determining stellar parallax is very rarely used at the present time. It consists in accurately measuring the Right Ascension and Declination of the star at different times of the year. After eliminating the effects produced by aberration, precession, proper motion, refraction, &c., the resulting positions show a periodic variation. And if it were possible to make the measures with mathematical precision, and all vitiating effects were exactly understood, every star would be found to describe a minute ellipse upon the background of space. The angular dimensions of the semi-major axis of the ellipse apparently described by a star, is that particular star's parallax. In the *differential* method, the fact that there are a number of stars in the heavens almost in the same line of sight is utilised. A star is chosen, and its position relatively to fainter stars near it is measured throughout the year. The faint stars are assumed to be at an infinite distance, and, if the star under investigation is nearer to the earth, it shows a slight shift of position with respect to them. Though only the *difference* of parallax is obtained by this method, the results are more reliable. In making the determination, a micrometer may be employed, or a heliometer, for both these instruments permit of the measurement of minute angles. Prof. Pritchard has very successfully employed photography in such investigations. The region surrounding the star the parallax of which is desired is photographed from time to time, and the relative positions of the stars upon the pho-

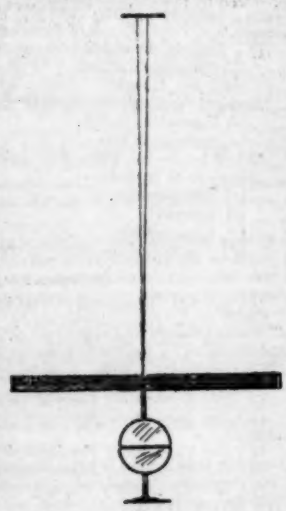
Fig. 3.

tographic plate are then conveniently measured under the microscope instead of doing the work with a micrometer or heliometer. Another advantage of this method is that the measures can easily be verified. The parallactic ellipse is found from the measures in the same way as the differential method.

(3.) In what respects does the globigerina-ooze resemble chalk, and how does it differ from that rock?

Both globigerina-ooze and chalk are made up largely of shells of Foraminifera, coccoliths, fragments of shells of molluscs, and other calcareous remains of organisms. There is a considerable difference, however, in the proportion of calcareous matter (carbonate of lime), for the ooze contains, on the average, about 60 per cent., whereas chalk contains quite 98 per cent. In chalk, also, there is an almost entire absence of inorganic matter, invariably found in globigerina-ooze. Chalk contains a larger proportion of the remains of large organism than the ooze, but this is probably due to different environments.

(4.) How has the rate of propagation of earthquake vibrations been determined? What do you know concerning the results arrived at?

The delicate seismometers now set up in many observatories record earth-movements much too small to be directly observable. By such means the earthquakes are detected at a considerable distance from the places where they are felt. Thus, an earthquake on the Italian Riviera affected the instruments at Greenwich Observatory. By recording the exact times at which the same earthquake visits different places at a known distance apart, the velocity of the wave can be calculated. (Velocity = distance ÷ time.) The velocity with which the waves travel differs according to the character of the rocks traversed. It is about two miles per second in granite, and less than 1,000 feet per second in sand and clay. Mallet found that an earthquake at Calabria in 1857 travelled in different rocks at rates from 650 to 1,000 feet per second.

(5.) Give an account of recent researches in connection with one of the following subjects:—

(*a*) The origin of new stars.

(*b*) The formation of certain schistose rocks from massive igneous rocks.

(*a*) See article on New Stars in THE PRACTICAL TEACHER, April 1892. The facts there given bear out Prof. Lockyer's conclusion that 'new stars, whether seen in connection with nebulæ or not, are produced by the clash of meteor-swarms, the bright lines seen being low-temperature lines of elements, the spectra of which are most brilliant at a low stage of heat.

(*b*) An account of the researches referred to was given by Prof. Bonney in the Rede Lecture for 1892, reprinted in *Nature*, June 23, 1892. The great group of crystalline rocks known as schists and gneisses have been formed in one of three different ways, which are stated by Prof. Bonney as follows:—(1) Some have once been molten, but have become solid under rather exceptional circumstances, probably having lost heat slowly, and having continued to move very gradually during the process of consolidation. (2) Others have been produced by the thorough alteration of sedimentary materials, in which a high temperature has been maintained for a long time in the presence of water and under considerable pressure. (3) Others, again, have been the result of great pressure which has acted on rocks already crystalline, and has produced mineral changes, sometimes to the complete obliteration of the original structure.

Certain gneisses and schists are thus due to the crushing of such igneous rocks as granites, dolerites, &c., indeed pressure seems to be the dominant agent in producing a schistose structure.

General Questions.

(1.) State what you know concerning the supposed causes of the Glacial Epoch which have been advocated by different authors. (Honours 1891.) See Note. January, p. 381.

(2.) Give an account of recent conclusions with regard to the formation of mountains. See Note. January, p. 381.

(3.) Describe briefly Lapace's hypothesis of the origin of the Sun and planets.

(4.) Give an account of Professor George Darwin's researches on the effects produced on the motions of the Earth and Moon by tidal action. (Honours 1892.)

(5.) What are the chief facts derived from observations of Mars during the opposition of 1892?

(6.) Give an account of recent results of observations of the planet Venus.

(7.) How does the spectroscope furnish evidence on the existence of (*a*) double stars so close together that no telescope can separate them, (*b*) dark stars?

(8.) Give an account of recent researches on the formation of dew.

(9.) What theories have been proposed to account for lake-basins in solid rock?

(10.) State the recent conclusions with regard to the development of coast lines.

(11.) Give an account of the arguments in favour of the permanence of ocean basins, and objections to them.

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NOTES AND VOCABULARY TO 'LA JEUNE SIBÉRIENNE.'

[*N.B.—The rules referred to will be found in the* PRACTICAL TEACHER *for September*, 1892.]

52.37.—*apprit*, pret., ind., 3 sing., of *apprendre*, learn.

52.38.—*elle était depuis si longtemps*, she has been so long. The simple imperfect with *depuis* is used to express a state or action which was still continuing in some past time.

52.46.—*conta*, pret., ind., 3 sing. of *conter*, relate.

52.46.—*infructueuses*, adj., fem., pl.; fruitless.

52.47.—*faites*, past part., fem., pl. of *faire*, make. Past part. is fem., pl., by Rule D.

53.4.—*mieux que moi*, better than I. *Moi*, the nominative case of the disjunctive 1 pers. pron. is used here instead of *je* because the vb. is *understood*.

53.5.—*n'aurait pu*, would have been able. *Ne* is used because *personne*, in the sense of *nobody*, is the nom. to the verb.

53.6.—*parents*, noun, masc., pl.; relations. *Parents* = both *parents* and *relations*, in French.

53.7.—*d'assez grande importance*, lit. 'of *somewhat* great importance.' This is the meaning of *assez* when preceding an adjective.

53.10.—*nous sommes brouillés depuis quelquet emps*, we have been bad friends for some time. The present with *depuis* is used because a continuing state in the present time is referred to. See 52.38.

53.14.—*nous voilà*, lit. 'behold us.' Translate, 'we are.'

53.16.—*soyez*, pres., subj., 2 pl. of *être*. Subj. is used after vb. *charmé*, expressing an emotion.

53.20.—*témoignèrent*, pret., ind., 3 pl. of *témoigner*, witness.

53.23.—*tout à coup*, all at once. Lit., 'all at a stroke *or* blow.'

53.24.—*salle à manger*, dining-room. *Salle* = room, *manger* = to eat. The joining of *manger* to the noun by *à* indicates the *purpose* to which the room is put.

53.30.—*s'entretint*, pret., ind., 3 sing. of *s'entretenir*, carry on conversation; talk.

53.32.—*convint*, pret., ind., 3 sing. of *convenir*, agree.

53.33.—*s'adresser au Sénat*, apply to the Senate.

53.37.—*aurait pu durer*, lit. 'might have been able to last.' Translate, 'might have lasted.'

53.40.—*d'en chercher les moyens*, lit. 'to seek the means of it.' Translate, 'to seek the means of doing so.'

53.44.—*la société*, the company.

53.45.—*la fit reconduire*, had her taken back; caused her to be taken back.

54.2.—*admirait*, impf., ind., 3 sing. of *admirer*, wonder.

54.3.—*conduite*, past part., fem., sing., of *conduire*, lead. Past part is fem. sing. by Rule D.

54.5.—*comme* = as if.

54.5.—*pour les lui rendre favorables*, to make them favourable to her. *Make* with an adj. in a factitive sense, is translated in French by *rendre*.

54.7.—*elle se rappela*, lit., 'she recalled to herself.' Translate, 'she remembered.'

54.8.—*de ne plus y retourner qu'une fois*, to return there but once more.

54.10.—*que je ne lui avais demandé*, than I had asked of him. *Ne* is not translated. It is used because it is in a sentence depending on a comparative (*plus*).

54.15.—*sans lui*, lit. 'without him.' This is the French way of translating the English idiomatic expression, 'if it had not been for him.'

54.22.—*dont la foi la plus vive*, whose most lively faith.

54.22.—*dirigeait*, imperf., ind., 3 sing. of *diriger*, direct.

54.23.—*soutenait*, imperf., ind., 3 sing. of *soutenir*, sustain.

54.24.—*que prenaient—Wassili-Ostrow*, which her friends of Wassili-Ostrow took in her. Subj. is placed last because rel. pro. *que* precedes.

54.28.—*revenu*, lit. 'returned.' Translate, 'who had returned.'

54.28.—*depuis quelques jours*, lit. 'since some days.' Translate, 'a few days before.'

54.30.—*s'était mis aux enquêtes*, lit. 'had put himself at enquiries.' Translate, 'had made enquiries.'

54.32.—*pour laquelle*, for whom. *Laquelle* is used for the relative because it follows a preposition.

54.38.—*Celle-ci*, pro., fem., sing.; the latter.

54.39.—*pendant deux mois*, for two months. *Pendant* marks the whole duration, *depuis* the beginning, and *pour* the end of some period of time.

54.43.—*tellement*, so much. Adverb from *tel*.

54.44.—*l'emporta*, gained the victory.

55.2.—*galonné*, past part., masc., s. of *galonner*, covered with lace. From *galon*, lace.

55.2.—*c'était encore un sénateur*, he was another senator (lit. 'yet a senator'). *Ce* is used for *he*, because here we have a noun following the verb *être*.

55.5.—*à voix basse*, in a low voice.

55.6.—*haut*, noun, masc., sing.; top.

55.7.—*coups de sonnette*, lit. 'strokes of bell.' *Donna deux coups de sonnette*=rang the bell twice. *sonnette*=a house-bell. *Cloche*=a large bell, as a church-bell.

55.15.—*qui y régnaient*, which reigned there. *Y* is used for 'there,' because the place (*salon*) has just been mentioned.

55.16.—*d'appartement*, any apartment. *De*='any,' after a negative (*jamais elle n'avait vu.*)

55.17.—*éclairé*, past part., mas., sing. of *éclairer*, light.

55.17.—*la société*, the company, as in 53.44.

55.18.—*les jeunes gens*, the young folks.

55.19.—*autour d'une table*, round a table.

55.21.—*regards*, noun, mas., pl.; looks.

55.22.—*à une partie de boston*, at a game of whist.

55.23.—*dès que*, as soon as.

55.25.—*de s'approcher*, to approach.

55.29.—*tirer*, vb., inf.; draw.

55.30.—*sac*, noun, masc., sing.; bag.

55.31.—*d'en sortir péniblement la lettre*, to take the letter out of it with difficulty. *Sortir* is here used in its transitive sense=to take out.

55.32.—*chuchotaient*, imperf., ind., 3 pl. of *chuchoter*, whisper.

55.33.—*riaient*, imperf., ind., 3 pl. of *rire*, laugh. *Riaient tout bas*, lit. 'laughed quite low'=suppressed their laughter.

55.34.—*lut*, pret. ind. 3 sing. of *lire*, read.

55.36.—*jeu*, noun, masc., sing.; game. Here=cards.

55.37.—*ennuyait*, imperf., ind., 3 sing. of *ennuyer*, put out; annoy.

55.38.—*des doigts*, with his fingers.

55.41.—*gros*, adj., masc., sing.; stout.

56.1.—*replier*, vb., inf.; fold.

56.3.—*déconcertée*, past part., fem., sing. of *déconcerter*, disconcert.

56.4.—*il lui adressait la parole*, lit. 'he was addressing the word to her.' Translate, 'he was speaking to her.'

56.5.—*Que vous plaît-il?* lit. 'what does it please you?' Translate, 'what is your pleasure?'

56.6.—*ce qui fit rire tout le monde*. Take the words in the following order:—*ce qui*, which; *fit*, made; *tout le monde*, everybody; *rire*, laugh.

56.11.—*après avoir dit*, after saying. In English we may say 'after saying,' and 'after having said.' In French the gerund following *après* is *always* compounded of *avoir* with a past participle.

56.13.—*Congédia*, pret., 3 sing. of *congédier*, dismiss.

56.18.—*retenue*, past part., fem., sing. of *retenir*, keep. *Être retenue* = lit. 'to be kept.' Translate, 'to stay.'

56.29.—*occasion*, noun, fem., sing.; opportunity.

56.29.—*en particulier*, in private.

56.30.—*les personnes de la société*, lit. 'the people of the company,' *i.e.* 'the people who frequented the house.' Translate, 'the visitors.'

56.33.—*avait fait souvent parler à la princesse*, had often caused the princess to speak.

56.34.—*but*, noun, masc., sing.; object.

56.35.—*soit que*, whether. The following *soit que* = or, and both of them are followed by the subjunctive.

56.37.—*qui s'étaient chargés*, who had undertaken.

56.38.—*eussent*, impf., subj., 3 pl. of *avoir*, have.

56.39.—*n'eurent aucun résultat*, had no result. *Ne—aucun* = the adjective 'no.'

56.41.—*uniquement*, adv., solely.

56.43.—*voyait*, impf., ind., 3 sing. of *voir*, see.

56.43.—*assez souvent*, rather often; pretty frequently. See 53.7.

56.44.—*Pendant que*, whilst. *Pendant que* is a conjunction; *pendant*, a preposition.

57.1.—*secrétaire des commandements*, private secretary.

57.2.—S. M. I. = *Sa Majesté Impériale*, her Imperial Majesty.

57.5.—*de la faire parvenir* = lit. 'to make it arrive.' Translate, 'to deliver it.'

57.6.—*croyant*, pres. part. of *croire*, believe.

57.6.—*croyant secourir un pauvre ordinaire*, lit. 'believing to help an ordinary poor person.' Translate, 'believing that he was helping.'

57.7.—*lui avait destiné*, had intended for her.

57.8.—*lui fit dire*, lit. 'made say to her.' Translate, 'sent her word.'

57.8.—*passer chez lui*, call at his house.

57.10.—*en ville*, lit. 'in town.' Translate, 'out.'

57.11.—*accueillit*, pret., ind., 3 sing. of *accueillir*, welcome.

57.13.—*autant de surprise que de plaisir*, as much surprise as pleasure.

57.15.—*devait la conduire*, was to lead her.

57.20.—*sentit redoubler l'intérêt*. Take the words in this order: *sentit*, felt; *l'intérêt*, the interest; *redoubler*, redouble.

57.21.—*au premier abord*, lit. 'at the first onset.' Translate, 'at first.'

57.23.—*d'un vrai mérite*, of true merit. The indefinite article is used because we have here an abstract noun accompanied by an adjective.

57.24.—*se rencontrent*, meet one another. *Se* is used in this *reciprocal* sense also in line 27.

57.26.—*font*, pres., ind., 3 pl. of *faire*, make.

57.32.—*reconnut*, pret., ind., 3 sing. of *reconnaître*, recognise.

57.33.—*accueil*, noun, masc., sing.; welcome.

57.34.—*trompée*, past part., fem., sing. of *tromper*, deceive. Past part. is fem. sing. by Rule D.

57.35.—*pressentit*, pret., 3 sing. of *pressentir*, foresee. Lit.= to feel beforehand.

57.37.—*qu'elle n'en avait jamais éprouvé*, than she had ever felt. A negative is used because it depends on a comparative (*plus de confiance*).

57.38.—*bienveillance*, noun, fem., sing.; benevolence.

57.42.—*partagea*, pret., ind., 3 sing. of *partager*, share.

57.42.—*sans la connaître*, lit. 'without knowing her.' Translate, 'before he knew her.'

58.1.—*incessamment*, adv.; immediately.

58.2.—*les affaires*, noun, fem., pl.; business.

58.5.—*ordonna*, pret., ind., 3 sing. of *ordonner*, command.

58.6.—*fût*, impf., subj., 3 sing. of *être*, to be. Subj. because foll. a verb. expressing a command (*ordonna*).

58.7.—*ne s'attendait point à*, did not expect.
S'attendre à (something), to expect something.

58.8.—*elle en reçut l'assurance*, lit. 'she received the assurance of it.' Translate, 'she was assured of it.'

58.9.=*prête*, adj., fem., sing. ; ready.

58.10.—*à se trouver mal*, lit. 'to find herself ill.' Translate, 'to faint.'

58.12.—*s'écria-t-il*, cried he. *S'écrier*=to cry.

58.15.—*sachant*, pres. part. of *savoir*, to know.

58.16.—*témoigner*, vb., inf. ; to witness, express.

58.17.—*baisait*, impf., ind., 3 sing. of *baiser*, kiss.

58.19.—*faire agréer mes remercîments à l'homme bienfaisant*, causing my thanks to be kindly received by the generous man.
agréer=to receive kindly.

58.21.—*dont*, from whom.

58.23.—*sans rien changer à*, without changing anything in.

58.26.—*en approchant du palais impérial*, in approaching the imperial palace. *Approcher* is foll. by *de*.

58.28.—*qui lui en avait représenté l'entrée*, who had represented to her the entrance of it.

58.31.—*devant*, prep. ; before (of place).

58.31.—*vais*, pres., ind., 1 sing. of *aller*, go.

58.33.—*achevez*, imperat., 2 pl. of *achever*, finish.

58.35.—*sans faire la moindre demande*, without asking the least question.
Faire une demande, faire une question=ask a question.
le moindre is the superlative of *petit*, and is an alternative form with *le plus petit*.

58.36.—*dont*, in which. We say in English, 'The manner in which.' The French use the preposition *de* with verbs expressing manner. Hence the genitive *dont* (=of which) is used here.

58.42.— *d'après*, according to.

58.42.—*que lui en avait fait M. V—*, which *M.* V. had given her of it.

58.44.—*comme aurait pu—du monde.* The subj. and pred. are inverted here. The subj. is *une personne*, etc. Do not translate *le* (=it). Translate, 'As a person knowing the ways of good society might have done.'

58.46.—*but*, noun, masc., sing., object.

59.1.—*procès*, noun, masc., sing. ; trial.

59.1.—*loua*, pret., ind., 3 sing. of *louer*, praise.

59.3.—*lui fit remettre*, caused to be handed to her.

59.4.—*aussitôt*, immediately.

59.4.—*en attendant*, while waiting for.

59.7.—*pénétrée de son bonheur*, lit. 'penetrated with her happiness.' Translate, 'full of her happiness.'

59.12.—*put*, pret., ind., 3 sing. of *pouvoir*, be able.

59.18.—*vue*, past part., fem., sing. of *voir*, see. Past part. is fem. sing. by Rule D.

59.19.—*monter en voiture*, lit. 'get up into a carriage.' Translate, 'enter a carriage.'

59.20.—*pour se rendre*, to go. Lit. 'to betake herself.'

59.24.—*salon*, noun, masc., sing. ; drawing-room.

59.24.— *qu'elle venait d'obtenir*, which she had just obtained.
Venir de, foll. by inf. of another verb=to have just.

59.25.—*opéré*, past part. of vb. *opérer*, to effect.

59.28.—*parut*, pret., ind., 3 sing. of *paraître*, appear.

59.28.—*en faire davantage*, lit. 'to give more of it.' Do not translate *en* (=of it).

59.32.—*tournure*, adj., fem., sing. ; figure.

59.34.—*qu'elle en avait conçues*, which she had conceived from them.

59.39.—*de la protéger*, lit. 'to protect her,' *i.e.*, to act as her patrons.

59.42.—*après que*, after. Remember that the *que* after *après*, converts it from a preposition into a conjunction.

59.42.—*remises*, noun, fem., pl. ; fines.

60.3.—*qu'elle venait d'en recevoir*, which she had just received from him. See note on 59.24.

60.4.—*lui ôta*, took away from her.

60.5.—*fuie*, past part., fem., sing. of *fuir*, flee from. Past part. is fem. sing. by Rule D.

60.7.—*le lendemain*, noun, masc., sing. ; the next day. (By a printer's error *la* is put for *le* in Darqué's edition.)

(*Course of Study for May.*)

1. Exceptions to the rules for forming the feminines of nouns. Cases in which an entirely different word is used for the feminine.

2. Formation of adverbs in *ment* from adjectives. What are the rules for forming adverbs from adjectives, and what are the exceptions to the rule?

3. Conjugation of the irregular verbs *être, avoir, aller, venir, pouvoir.*

Examination Paper.

1. Translate : Tandis qu'elle examinait la statue, sa *compagne lui fit* observer que le pont de la Néva, qui était tout près, était replacé ; des voitures sans nombre se rendaient à Wassili-Ostrow et *en* revenaient. 'Avez vous la lettre de recommendation pour Mme. de L——,' lui demanda-t-elle ; 'je ne suis pas pressée et je puis vous conduire à sa porte.' 'Il était de *bonne* heure encore, et Prascovie y consentit.

2. Parse the words underlined.

3. (*a*) Give the feminine forms of *long, sot, sage, frais, léger, jaloux, bon, trompeur.*
(*b*) Decline *le mien, qui* (interrogative), *celui-là*.
(*c*) Give the past definite and future (first person singular) of *aimer, croire, dire, faire, mourir, pouvoir, savoir.*
(*d*) Distinguish *chaque* and *chacun, l'un l'autre* and *l'un et l'autre.*

4. Translate into French :—
(*a*) London is a very large and well-built city.
(*b*) Twenty articles make a score.
(*c*) This boy is not the one I spoke to on Monday.
(*d*) You will go with me if you are wise.
(*e*) He has not sent me a single exercise.
(*f*) Has my aunt given you all the things you asked for?
(*g*) The German master will come at a quarter to ten.
(*h*) No one believed that she had told the whole truth.

ANSWERS TO THE APRIL PAPER.

1. Mme. Milin smiled at these reflections of the young girl ; but the thought that nothing ought to be impossible to such true piety, to prayers so ardent. More than anything else, this thought persuaded the two charitable ladies that they ought to aid her in her plans and to leave her to Providence, which seemed to protect her so visibly. Mme. Milin and her friend had up to that time neglected nothing to dissuade her, and had made her the kindest offers in order to keep her near them.

2. *souriait*, impf., ind., 3 sing. of irreg. vb. *sourire.*
vraie, adj., fem., sing. agreeing with *piété.*
fallait, imperf., ind., 3 sing. of impersonal vb. *falloir*, to be necessary.
rien, noun, masc., sing., 3 pers., accus., govd. by *négligé.*
jusqu'alors, compound adverb of time, modifying *négligé.*

3. (*a*) *bateau*, pl. *bateaux.*
ville, pl. *villes.*
palais, pl. *palais.*
ciel, pl. *cieux*, heavens ; *ciels*, skies (in painting).
enfant, pl. *enfants.*
blanc, fem. *blanche.*
beau, fem. *belle.*
méchant, fem. *méchante.*
cruel, fem. *cruelle.*
complet, fem. *complète.*
jaloux, fem. *jalouse.*
(*b*) *notre plume*, pl. *nos plumes.*
ce bon cheval, pl. *ces bons chevaux.*
mon nouveau livre, pl. *mes nouveaux livres.*

(*c*)

	Sing.	*Plu.*
Nom.	Elle	Elles
Gen.	D'elle	D'elles
Dat.	Lui	Leur
Acc.	La	Les.

	Sing.	*Plu.*
Nom.	Lequel	Lesquels
Gen.	Duquel	Desquels
Dat.	Auquel	Auxquels
Acc.	Lequel	Lesquels.

(*d*) *Etre*, past def. 3 sing. *il fut*; 3 pl. *ils furent.*
Aimer, past def., 3 sing. *il aima*; 3 pl. *ils aimèrent.*
Concevoir, past def., 3 sing. *il conçut*; 3 pl. *ils conçurent.*
S'en aller, past def., 3 sing. *il s'en alla*; 3 pl. *ils s'en allèrent.*
Avoir, imperf., subj., 3 sing. *qu'il eût*; 3 pl. *qu'ils eussent.*
Fournir, imperf., subj., 3 sing. *qu'il fournît*; 3 pl. *qu'ils fournissent.*
Répondre, imperf., subj., 3 sing. *qu'il répondît*; 3 pl. *qu'ils répondissent.*

(*e*) *Durant*, from *durer*, to last.
Pendant, from *pendre*, to hang.
Concernant, from *concerner*, to concern.
Touchant, from *toucher*, to touch.

4. (*a*) Prascovie aima ses parents.
(*b*) Le soleil brille aujourd'hui.
(*c*) C'est vous qui avez fait ceci.
(*d*) Ils ont perdu leur fille chérie.
(*e*) Avez vous jamais vu ces dames auparavant?
(*f*) Qui a fait ceci? Moi, répondit l'enfant.
(*g*) Votre frère est-il venu?
(*h*) Les lettres que vous m'avez envoyées étaient mal écrites.
(*i*) Il faut que vous alliez.

N.B.—Examination papers will be corrected gratis for Students who are following the Practical Teacher Course in French. Send your worked papers to the office of this journal, marked outside 'Scholarship French,' and enclose a stamped addressed envelope for their return.

LEGAL AND CODE QUERIES COLUMN.

RULES.

1. All communications must be addressed 'Legal Editor, PRACTICAL TEACHER, 5, Pilgrim Street, Ludgate Hill, E.C.,' and must be accompanied by our 'coupon,' duly filled up.
2. Replies will be given *only* in this column, except under the conditions named in Rule 3.
3. If any reader desires a reply by post, such can be forwarded by enclosing, in addition to the coupon, a stamped addressed envelope and a shilling Postal Order.
4. No original documents should be forwarded, but copies only. We cannot hold ourselves responsible for any losses which occur through non-observance of this rule.

'PRECEPTOR.'—No, you cannot be compelled to submit your school to an inspection. If, however, you refuse all inspection, the school may be declared inefficient, and parents of scholars who attend, will be liable to prosecution for neglecting to cause their children to be educated.

'SECTARIAN.'—'No religious catechism or religious formula which is distinctive of any particular denomination,' can be taught in a Board School (33 and 34 Vict. c. 75 Sec. 14 (2)).

J.W.S.—If your Second Advanced was obtained prior to 1890, you are qualified to earn payments.

'ATTENDANCE.'—Children, between the ages of thirteen and fourteen, are subject to the provisions of the Act of 1876, and no child under fourteen can be employed, except under the conditions therein prescribed. These conditions are, either, (1) obtaining a certificate of proficiency in reading, writing and elementary arithmetic, or (2) obtaining a certificate of previous due attendance at a certified efficient school (39 and 40 Vict. c. 79 Sec. 5). The Standard of proficiency fixed at present, is IV., and of previous due attendance, two hundred and fifty attendances, in not more than two schools during each year, for five years whether consecutive or not.

M.W.—The Department in a memorandum issued on March, 9th of this year state clearly, 'The law does not give parents a right to free education, at the school which their children are attending, if that school has a right to charge fees.' The managers have a right to demand the prepayment of the fees, and to refuse admission to any child who presents himself without the fee. Arrears of fees are not legally recoverable.

'MANUAL INSTRUCTION.'—Ask your managers to apply to the Education Department for a copy of circular 44. It gives full particulars. You will also find some information in the Science and Art Directory.

M.N.—It is not requisite to the validity of a will that it should assume any particular form, or be couched in any technical language. The intention of the testator must be clearly conveyed. The will must be signed by the testator at the foot in the presence of two witnesses. These witnesses must sign in the presence of each other and of the testator. The witnesses should be disinterested parties.

Replies by post to X.Y., I.M.S. and 'Practical Teacher,' A.B., 'Easter' and W.N.

OUR 1893 CERTIFICATE CLASS.

BY DR. GEORGE BEACH, M.A.

Co-Author of a 'Manual of our Mother Tongue,' 'A Girls' Arithmetic,' Author of 'Elements of English,' Entertaining Readers, etc.

II. REMARKS ON ROUTINES.

(*a*) These are so thought out that whilst every part of the syllabus will be traversed *several* times, the more difficult, the most important, and the most frequently recurring in examination, will be gone over *many* times.

(*b*) When the Syllabus for Men and Women or for First and Second Year coincides, the same work or the same subjects will be planned for both. When the Syllabus varies, it will be differentiated as little as possible, and such subjects as Sewing and Domestic Economy will be planned for Women, whilst the Men are engaged in Mathematics.

(*c*) It will be understood that when the rectangle representing an hour's work is halved, the upper portion is devoted to the Men (Spencer or Staff Notation, &c.), whilst the lower half is arranged for Women (Quick or Tonic Solfa).

(*d*) The difficult words to be parsed are as follows:—

FIRST YEAR.

(1) *Messenger, name, what, as, cloth, delivering, even, knight, more, to accept,* OR *anon, such, as, heroes, arming, breathed, wanting, thoughts, chase* (First Friday).

(2) *Thereon, each, three, on, pain, to keep, sets, laden, to discdge, themselves, like,* OR *high, where, exalted, raised, beyond, insatiate, Deities, for, since, for, lost* (Third Monday).

(3) *This, used, to play, scratch, each, redder, than, Gareth, joy, once, news, whereon,* OR *frowning, less, gods, Belial, humane, seemed, though, appear, reason, for, industrious* (Fourth Monday).

SECOND YEAR.

(1) *Killed, herself, whilst, let, frame, disjoint, ere, that, better, whom, to gain, than, to lie,* OR *now, when, itself, drink, as, on, soft, heart, lose, be, unnatural, none, be, server* (First Wednesday).

(2) *Ere, ay, too, have been performed, terrible, that, when, out, there, end, than, such,* OR *presentment, what, was seated, to threaten, station, like, indeed, where, to give, blasting* (Fourth Monday).

(*c*) Paraphrase :—
Lines 24 to 39 of Macbeth, Scene 6, Act III., OR
Lines 32 to 46 of Hamlet, Scene 4, Act IV. (Third Saturday.)

III. NOTES ON HISTORY.

i. MEN, FIRST AND SECOND YEAR.

(*a*) *Principal Authors during the Eighteenth Century.*

(α) *First Rate*—(Poets) Pope, Thomson, Young, Gray, Collins, Goldsmith, Cowper, Chatterton, Burns, Wordsworth, Sir W. Scott, Coleridge, Southey, Campbell, Moore, Kirke White; (Historians and Political Writers) Burnet, Hume, Gibbon, Robertson, 'Junius,' Burke; (Theologians, Philosophers, etc.) Bentham, T. Paine, Butler, Locke, Berkeley, Adam Smith, John Wesley, Granville Sharp, Paley, Wilberforce, Dugald Stewart; (Novelists, etc.) Defoe, Swift, Richardson, Sterne, Smollett, Maria Edgeworth, Boswell, Jane Austen; (Essayists, etc.) Steele, Addison, Dr. Johnson, Lord Jeffrey, Lamb.

(β) *Second Rate*—(Poets) Prior, Congreve, Watts, Ambrose Philips, Parnell, Ramsey, Tickell, Gay, Savage, Shenstone, Akenside, Charles Wesley, *Percy*, Churchill, Darwin, Beattie, *Macpherson*, Sir W. Jones, *Dibdin*, Richard Sheridan, *Crabbe*, Rogers, James Montgomery; (Historians and Political Writers) *Evelyn, Pepys;* (Theologians, etc.) Prideaux, Matthew Henry, Warburton; (Historians and Political Writers) Delolme, Sir James Mackintosh; (Theologians, Philosophers, etc.) John Newton, Toplady, Rowland Hill, Adam Clarke, Chalmers; (Novelists) *Mackenzie*, Madame D'Arblay *Beckford, Lewis.*

(γ) *Third Rate*—(Poets) Wycherley, Cibber, John Philips, Broome, Blair, Foote, Mason, Cumberland, Wolcott, Bruce, Logan, Gifford, Bloomfield, Landor.

ii. WOMEN, SECOND YEAR.

First Rate—(Poets) Spenser, Shakespeare; (Theologians, etc.) Latimer, Cranmer, Hooper, Knox, Foxe, Hooker; (Miscellaneous) Gentilis, Coke, Bacon.

Second Rate—(Poets) *Dunbar*, Surrey, *Raleigh*, Sidney, *Chapman*, Southey, Marlowe, Drayton, *Ben Jonson*; (Historians, etc.) *Sir Thomas More, Hakluyt;* (Theologians, etc.) *Coverdale, Tyndale*, Jewell, *Brown;* (Scholastic) Ascham.

Third Rate—(Poets) *Sternhold and Hopkins.*

Space prevents us from giving to our Readers further details respecting the above-mentioned authors, but we strongly advise them to draw up three tabulated lists in their note-books of the first, second, and third ranks of literateurs. The dates and chief works should be subjoined. The list of first rates should be often perused and their lives carefully studied, the second list (paying attention to the italicised names) less frequently, and the third list but casually.

(*b*) *Government Questions already given upon Tudor Period.*

1. Write short accounts of Shakespeare, Wolsey, Thomas Cromwell, Drake, Katherine of Aragon, Cranmer, Queen Elizabeth, Raleigh, and Knox. (1870), (1872), (1873), (1875), (1876), (1879), (1880), (1882), (1884), (1885), (1887).
2. What was the 'Statute of the Six Articles?' Give an account of the chief proceedings under it, and the cases of those who suffered thereby. (1870), (1871), (1872), (1874), (1886).
3. Describe the war between England and Scotland in 1542. (1870), (1874).
4. The changes made in the reign of Queen Mary, and the character and death of Cranmer. (1870.)
5. An account of the religious and political principles of the Puritans, and of their chief men. (1870.)
6. Describe the chief constitutional changes of the Tudor Period. (1870), (1875), (1883), (1886.)
7. What were the charges against Mary Queen of Scots? Give particulars of her trial and death. (1870), (1878).
8. What were the claims of Henry VII. to the crown, and how were they settled by Parliament? (1870), (1871), (1872), (1873), (1874), (1881), (1882), (1887), (1888), (1890), (1891).
9. The pretensions of Perkin Warbeck; his invasion; the support afforded him from Scotland and Burgandy. (1870), (1871), (1875), (1892).
10. The political character of Henry VII.; the improvements in law and commerce during his reign. (1870), (1871), (1875), (1876), (1879), (1883), (1886).
11. The war with France, 1512–1514. (1870.)
12. The policy of Somerset in the reign of Edward VI.; the accusations against him; the causes of his condemnation. (1870), (1874), (1875), (1892).
13. The state of Ireland in the reign of Queen Elizabeth. (1870), (1875), (1879), (1880), (1882), (1883), (1885), (1889).
14. The expedition against Cadiz in 1596. (1870), (1872).
15. The character of Sir T. More, Cardinal Pole, Sir P. Sidney, and Lord Burleigh. (1870), (1872), (1873), (1889).
16. The conspiracies of Henry VII.'s reign. (1870), (1871), (1873), (1874), (1877), (1886).
17. Chronological account of wars with Scotland in Henry VIII.'s reign. (1870), (1871), (1875), (1882), (1889).
18. Give particulars of the marriage of Queen Mary I., and state its consequences in her own and the following reigns. (1870), (1873), (1885).
19. Give the sovereigns of the Tudor family, with their dates. Under each mention events of importance. (1871.)
20. Mention the marriages and issue of Henry VIII. What political motive has been assigned for his repeated marriages? Show its importance to the nation. (1871), (1889).
21. Describe the relations of England under Elizabeth towards Scotland, Spain, Netherlands, and France. (1871), (1882), (1883), (1890), (1892).
22. What different views are taken of the character of Mary Queen of Scots? Illustrate your answer by the events of her life. (1871), (1872), (1873), (1874), (1875), (1879), (1880), (1881), (1882), (1883), (1885), (1887), (1889).
23. How was England interested in the League of Cambay and the Holy League? What effect had the latter upon Scottish history? (1871), (1882).
24. The 'Pilgrimages of Grace.' (1871), (1873), (1878), (1883), (1887).
25. At the death of Edward VI., what ladies were interested in the succession? Investigate their respective claims and describe any attempts made to assert them. (1871), (1872), (1881), (1887).
26. The progress of commerce under Mary and Elizabeth. (1871).
27. The 'Bill of Attainder'; by whom devised, how long employed; with mention of some of its victims? (1871), (1888).
28. What was 'Maintenance' or 'Livery'? When was it abolished? (1871.)
29. What part did Henry VII. take in the affairs of Europe? (1871), (1872).
30. Distinguish the character and policy of the Tudors from those of the Stuarts. (1871.)

(*To be continued.*)

(*c*) GOVERNMENT QUESTIONS ALREADY SET RESPECTING THE EIGHTEENTH CENTURY.

1. Trace the progress of colonization during the eighteenth century. (1870.)
2. The National Debt and Revenue from 1700 to 1801. What measures were passed respecting the former in 1750? (1870), (1872), (1876), (1877), (1882), (1892).
3. The 'Union of England and Scotland,' details of the conditions and chief negotiators. (1870), (1872), (1875), (1876), (1878), (1880), (1882), (1884), (1888).
4. A detailed account of Blenheim, Quebec, Ramillies, Culloden, Dettingen, Minden, Plassey, Fontenoy. (1870), (1874), (1875), (1876), (1879), (1881), (1882), (1886), (1887), (1888), (1889).
5. The terms of the peace of Utrecht. (1870), (1871), (1874), (1879), (1889), (1891).
6. The events and results of the war with Spain, proclaimed 1739. (1870.)

7. The chief events which ended in the declaration and establishment of American Independence. (1870), (1871), (1873), (1874), (1875), (1877), (1878), (1880), (1882), (1883), (1884), (1885), (1886), (1888), (1889), (1892).

8. The storming of Seringapatam and the overthrow of Tippoo Saib. (1870.)

9. The growth of the East India Company. (1870), (1872), (1873), (1874), (1875), (1876), (1878), (1882), (1890), (1891).

10. Write an account of the South Sea Scheme and the Mississippi Scheme. (1870), (1871), (1874), (1884).

11. Mention the chief exploits of British seamen in the reign of George II. (1870.)

12. Write a life and character of Clive, Pitt, Nelson, Burke, Fox, Wolfe. (1870), (1871), (1872), (1874), (1875), (1876), (1877), (1881), (1886), (1887), (1889).

13. How did the Stuarts finally lose the throne? What efforts did they make to recover it? (1871), (1872), (1873), (1874), (1875), (1876), (1879), (1881), (1882), (1883).

14. The English navy and its chief exploits during the eighteenth century. (1871.)

15. The war of the Spanish Succession. (1871), (1872), (1874), (1876), (1879), (1882), (1885).

16. The state of trade, 1792–7, and the public measures taken to support mercantile credit. (1871), (1872), (1873), (1883).

17. What effect has the steam-engine exercised upon our national prosperity? How was its use in manufactures first received by the people and protected by law? (1871), (1877), (1885), (1887), (1892).

18. The condition of France at the outbreak of the First Revolution, and the objects of England in declaring war. (1871), (1872), (1878).

19. The rising of United Irishmen in 1798. (1871), (1873), (1874), (1884).

20. What was the Right of Search? Explain the principles of the 'Armed Neutrality.' (1871.)

21. The mutinies at Portsmouth and the Nore. (1871), (1885), (1886), (1892).

22. Under what circumstances did the House of Hanover succeed to the English Throne? Mention some of the consequences of that succession. (1871), (1873), 1881).

23. Describe the conquest of Canada. (1871), (1872), (1873), (1878), (1881), (1890).

24. Mention some of the most remarkable statesmen and warriors in the reign of George III., and give a particular account of one of them. (1871), (1882).

25. Mention, with dates, the most remarkable inventions of the eighteenth century. (1871), (1875), (1877), (1879), (1882), (1886).

26. Write short accounts of Walpole, Chatham, Washington, Warren Hastings, Addison, Marlborough, Dr. Johnson, Pitt, Fox, Wesley. (1872), (1874), (1878).

27. Who was Queen Anne? Give some account of naval and military successes in her reign. (1872), (1873).

28. What was the Peace of Versailles? Mention its chief articles. (1872), (1889), (1891).

29. What was the occasion of the Septennial Act, and what changes did it introduce? (1872), (1879), (1881), (1882), (1890).

30. The capitulation of Cornwallis and its consequences. (1872.)

(*To be continued*).

IV. TUITION.—We have now made arrangements with a staff of distinguished Graduates and experienced Certificated Teachers to undertake in connection with these columns tuition by correspondence. The fee will be 15s. 9d. per quarter paid in advance, and will be inclusive, no further charge being made for Latin, French, Drawing, or postage. The Drawing will be under the charge of Mr. Ward, late assistant to Sir F. Leighton, R.A., and author of 'Principles of Ornament,' an excellent artistic work published by Chapman and Hall under the auspices of the Science and Art Department, South Kensington. A month's tuition may be had for 6s., and one series of papers for 1s. 6d. The first 20 pupils in each year will receive the PRACTICAL TEACHER free, and it is hoped shortly to inaugurate a liberal Prize Scheme.

SELECTED GOVERNMENT QUESTIONS.

SECOND YEAR.

FIRST WEEK.

1. As in First Year.

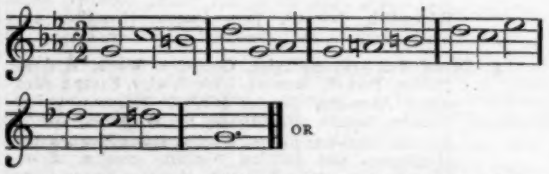
2. As in First Year.

3. What is understood by 'Habit,' and what laws of mental science control the formation of habits? Say what is in the power of school discipline to do in the encouragement of right habits.

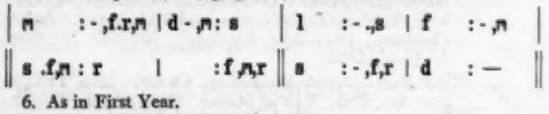
4. What does Spencer mean by insisting on the importance of self-development? What practical conclusions respecting methods of education does the author deduce from his argument on the subject? *or*

Explain this paradox—'Everyone can teach that which he does not know himself.'

5. Transpose the following passage a minor third lower, *i.e.* from C minor to A minor.



Write in figures over the following the duration value in pulses or fractions of a pulse (as 1, ½, ¾, etc.) of each note and rest :—



6. As in First Year.

7. (*Men only.*) Paraphrase Lines 51 to 61 of Act I., Scene 3, Macbeth.

(*Women only.*) Sketch the character of Hamlet.

8. (*Men only.*) As in First Year.

(*Women only.*) Who were Plato, Socrates, Hecuba, Dionysius, Hermogenes, and Archimedes.

9. (*Men only.*) As in First Year.

(*Women only.*) What industries are carried on at Droitwich, Limerick, Peterhead, Kirkwall, Burslem, Walsall, Paisley, and Coventry?

10. (*Men only.*) As in First Year.

(*Women only.*) Describe the chief centres of Australian gold-mining, sheep-rearing, and coal-getting.

11. (*Men only.*) As in First Year.

(*Women only.*) Briefly sketch our relations with Scotland during the Tudor period.

12. (*Men only.*) As in First Year.

(*Women only.*) Give the chief provisions of the Statute of Six Articles, and the Acts of Uniformity, 1549 and 1559.

13. (*Men only.*) If the cost of paving a circular court 42 feet in diameter be £63, find the cost of paving one the diameter of which is 78 feet. Ans. £217 5s. 8¼d.

(*Women only.*) A merchant insures a ship and cargo for £15,320 at a premium of 4½ per cent. to cover both the value of the ship and the cost of insurance. Find the premium and the value of the ship and cargo. Ans. £651 2s. 0d.; £14,688 18s. 0d.

14. As in First Year.

15. (*Men only.*) As in First Year.

(*Women only.*) Cut out on paper the right half of a child's muslin pinafore.

16. (*Men only.*) The sides adjacent to the right angle of a triangle are 9 in. and 3ft. 4 in. If it revolve about the hypothenuse find the volume of the generated solid. Ans. 1 c. ft. 1583$\frac{43}{337}$ in.

(*Women only.*) Give a receipt for making barley-water, and say when and in what sort of illnesses it is most useful.

17. (*Men only.*) Find the sum of a given no. of quantities in A. P., the first term and the common difference being given.

If the A. mean between a and b be twice as great as the G. mean, find the ratio of a to b.

Ans. $\frac{a}{b} = 7 \pm 4\sqrt{3}$.

(*Women only.*) Describe the equipment of a kitchen suitable for teaching cookery in a country school, and give in detail an estimate of the cost of fitting it.

18. (*Men only.*) As in First Year.

(*Women only.*) The Banker's discount on a bill due in two months at 5½ per. cent. is £19 5s. 0d. What is the amount of the bill?

Ans. £2100.

19. (*Men only.*) Write out Euclid VI. 4.

D is any point in the base BC of the triangle ABC; EFG a straight line parallel to BC cuts AB, AD, AC, or these produced in E, F, G respectively. Prove that $\frac{EF}{FG} = \frac{BD}{DC}$.

THIRD WEEK.

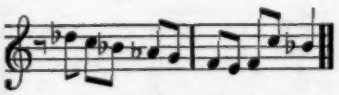
1. As in First Year.

2. As in First Year.

3. In what various ways may children be rewarded for good conduct and proficiency in their studies? Say what kinds of reward appear to you to be most legitimate, and what kinds are open to objection.

4. Write out a pattern sketch of a lesson on one of these subjects:—
   (*a*) Early hours.
   (*b*) Digestion.
   (*c*) The need of law and of obedience (i) in the school, and (ii) in the home.

5. State the key of each of the following passages:—



OR,

Write the following values in three-pulse measure. The figures show duration in pulses or fractions of a pulse. Begin on a strong pulse:—

1½, ½, ¾, ¼, 1½, ½, ½, ½, ½, ½, ½, ½, ½, ½, ½, 3.

m, s, f, l, r, m, f, rest, rest, r, s, f, m, r, d, t_1, d.

6. As in First Year.

7. As in First Year.

8. Analyse the subjoined passage, and parse the words in italics.

(*Men only.*) As in First Year.

(*Women only.*)

If it *assume my* noble *father's* person,
I'll speak to it, *though* Hell *itself should gape*
And bid me *hold* my peace. I pray you *all*
If you have hitherto *concealed* this sight,
Let it *be tenable* in your silence *still*;
And *whatsoever else* shall hap to night,
Give it an understanding *but no* tongue,
I will requite *your* loves.

9. (*Men only.*) As in First Year.

(*Women only.*) Describe the exports, imports, and government of New Zealand.

10. (*Men only.*) As in First Year.

(*Women only.*) Draw a political map of New Zealand.

11. (*Men only.*) As in first year.

(*Women only.*) What insurrections occurred between 1487 and 1550; and with what results?

12. (*Men only.*) As in first year.

(*Women only.*) Enumerate, giving their works, the chief authors of the Tudor period.

13. (*Men only.*) The compound interest for 3 years at 5 per cent. on a certain sum is £19 14s. 0¾d. Find the sum.

Ans. £125.

(*Women only.*) A makes an article and sells it to B; B sells it to C, and then C to D for 35s. A makes 20 per cent. profit; B 25 per cent.; C 40 per cent. What did it cost A to make it?

Ans. 16s. 8d.

14. As in first year.

15. (*Men only.*) As in first year.

(*Women only.*) Draw a diagram one eighth size on squared paper of a woman's night-dress.

16. (*Men only.*) A prism is 24 inches long. Its ends are triangles the sides of which are 12 inches, 17 inches, and 25 inches respectively. Find the content of the prism. Ans. 2,160 c. ins.

(*Women only.*) Say what you would do in the case of a child who had (*a*) fallen into the fire-place and been burned; (*b*) been scalded; (*c*) deeply cut by a knife.

17. (*Men only.*) The square root of a rational quantity cannot be partly rational and partly a surd. Find the square root of $10\frac{1}{2} + 2\sqrt{5}$.

Ans. $\sqrt{10} + \frac{1}{\sqrt{2}}$.

(*Women only.*) What are the advantages and drawbacks of Clothing-clubs, shoe-clubs, or any such contrivances for saving in a school. How do they compare in usefulness with the Post Office Savings Bank?

18. (*Men only.*) As in first year.

(*Women only.*) Reduce to decimals and add together:—

$\frac{1}{27} + \frac{27}{10000} + \frac{159}{999} + \frac{221}{858}$.

Ans. .4464619437.

19. (*Men only.*) Write out Euclid VI. 6.

In the hypothenuse AB of a right-angled triangle a point D is taken so that BC is a mean proportional between AB and BD. Show that AB is perpendicular to CD.

FIRST YEAR.

FIRST WEEK.

1. Write in Large-hand the words *Cambridge University.*
   Write in Small-hand the lines:—

Oh, say not so, thou holy friar,
I pray thee say not so.

2. Write from Dictation:—

'If anyone would investigate the sort of teaching which is considered adapted to the capacity of children at this stage, let him look into a work still in vogue, from which the young of both sexes acquire a great quantity and variety of learning; the whole of ancient and modern history and biography, together with the heathen mythology, the planetary system, and the names of all the constellations, lying very compactly in about three hundred pages.'

3. Grammar has been sometimes defined as '*the art of speaking and writing the English language with propriety.*' How far does this definition appear to you to be true or adequate? By what expedients other than the teaching of technical grammar is it possible to enrich a scholar's store of words, and to encourage precision in the use of them?

4. What do you regard as the special disciplinal and educational value—apart from their practical utility—of (*a*) Mental Arithmetic, (*b*) Geography, (*c*) Logical Analyses, and (*d*) Fröbelian exercises in Drawing?

5. Write a moderately difficult time exercise in ⅜ time, eight bars in length, suitable for study by children in the higher standards. No two bars should be exactly alike.

(*Tonic-Solfa*) State the relation, as dominant, *etc.*, of the following notes (*a*) *lah*, (*b*) *ray*, (*c*) *soh*, (*d*) *me*, (*e*) *fah*, (*f*) *te*.

6. State briefly the meanings of the following terms, etc.: Da Capo, Triple Time, M. 70, Tempo Primo, Andante, and Sotto voce.

7. Give the etymology of:—

(*Men only.*) *church, pagan, heathen, sophist, sacrament, emperor,* and *frank.*

(*Women only.*) *forfeited, chamber, politician. ingenious, malignity, biographer and hydrostatics.*

(*Men only.*) '*Tennyson's verse is informed with the very spirit of Honour, of Duty, and of Reverence.*' Quote passages from 'Gareth and Lyrette' exemplifying this statement.

(*Women only.*) Give some examples of the way in which proper names—either of persons or of places—have given rise to words which have taken a permanent place in our vocabulary.

CERTIFICATE ROUTINE FOR MAY, 1893 (MEN AND WOMEN, FIRST YEAR).

DAYS	FIRST WEEK.			SECOND WEEK.			THIRD WEEK.			FOURTH WEEK.		
	First Hour.	Second Hour.	Third Hour.	First Hour.	Second Hour.	Third Hour.	First Hour.	Second Hour.	Third Hour.	First Hour.	Second Hour.	Third Hour.
MONDAY	Notes of a Spelling Lesson to Standard III.	Read Trench, Lecture V., *or* pp. 1 to 25 of Johnson's 'Milton'	Euclid, Book III., Props. 8 to 15, *or* Repairing Underclothing	Rewards and Punishments	Study the Notes to Lecture V., *or* pp. 1 to 25 of Johnson's 'Milton'	Euclid, Book III., Props. 16 to 24, *or* Paper Pattern of a Pair of Drawers	Sequence of Intellectual Development	Analyse lines 179 to 194 of 'Geraint and Enid,' *or* Lines 1 to 14 of 'Paradise Lost,' Book II.	Euclid, Book III., Props. 25 to 31, *or* Any Needlework	The Range of the Teacher's Influence	Analyse and Parse lines 521 to 531 of 'Gareth and Lynette,' *or* Lines 106 to 118 of 'Paradise Lost,' Book II.	Euclid, Book I., Props. 14 to 26, *or* Answering Needlework Questions
TUESDAY	Chief Dates from 1603 to 1660	Problems involving Quadratics, *or* Composition of Food	Geography of Arabia and Persia	Chief Dates from 1660 to 1688	Ratio and Proportion of Algebra, *or* Cleansing of Clothing	Latitude and Longitude, with Problems thereon	Tables of the Battles of the 'Wars of the Roses' and 'The Great Rebellion'	Evolution and Variation of Algebra, *or* Warming and Lighting of the Home	Geography of South-Eastern Asia	Chief Dates from 1688 to 1714	Problems on Simple Equations, *or* Processes of Respiration, etc.	Distribution of Animals
WEDNESDAY	English Composition on 'The Fusion of Races.'	History from 1603 to 1660	Mensuration of the Square, *or* Mental Arithmetic	Percentages	Drawing	Mensuration of Rectangles, *or* Compound Proportion	Theory of Practice and Proportion	Trench, Lecture VI., *or* Grammar from Text-Book	Discount	Work Examination Questions in Arithmetic	Repetition, Literature, and Penmanship	Geography of Central Asia
THURSDAY	History from 1727 to 1744, *or* Growth of our Navy	Problems involving Quadratics, *or* Nutritive Value of Food	Map of Palestine	History from 1660 to 1688	Involution and Evolution of Algebra, *or* Clothing Outfits	Effects of Climate on National Character	Constitutional Affairs from 1066 to 1215	Simultaneous Simple Equations, *or* Cleaning Rooms and Furniture	Map of China	History from 1688 to 1714	G.C.M. and L.C.M. of Algebra, *or* Ventilation	Tennyson's Poems, *or* Any School Management
FRIDAY	Drawing	Deductions on Euclid, Book I., *or* Diagram of a Pair of Drawers for a Child of Five	Analyse lines 376 to 391 of 'Gareth and Lynette,' *or* Lines 549 to 559 of 'Paradise Lost,' Book I. Parse difficult words	Profit and Loss	*Study* Lecture V., *or* pp. 1 to 25 of Johnson's 'Milton'	How to Train the Hand	Notes of a Lesson in Freehand Drawing to Standard IV.	Deductions on Euclid, Book II., *or* Cutting out of a Woman's Chemise	Read First Half of 'Gareth and Lynette,' *or* 'Paradise Lost,' Book I.	Mensuration of Parallelograms, *or* Present Worth	How to Teach Grammar, *or* 'Form'	Read First Half of 'Geraint and Enid,' *or* 'Paradise Lost,' Book II.
SATURDAY.	Music, Signatures of the Simple Times, *or* 2, 3, and 4 pulse measures	Science	Examination	Music, All the Major Scales, *or* Mental effects of Notes	Science	Examination	Music, Contents of Measures	Euclid, Book I., Props. 1 to 13, *or* Historical Dates	Examination	Musical Terms in Common Use	Historical Dates	Examination

CERTIFICATE ROUTINE FOR MAY, 1893 (MEN AND WOMEN, SECOND YEAR).

DAYS	FIRST WEEK.			SECOND WEEK.			THIRD WEEK.			FOURTH WEEK.		
	I.	II.	III.	I.	II.	III.	I.	II.	III.	I.	II.	III.
MONDAY	Jevons' Logic, first 22 pp.	Read 'Macbeth,' Act III., *or* 'Hamlet,' Act III.	Revise Euclid, Book III., *or* Tucking and Marking with Cross Stitch	The influence of Cleanliness and Method upon Health of Teachers and Schools	Deductions on Euclid, Book III., *or* Diagram of a Woman's Nightdress	Read 'Gareth and Lynette,' *or* 'Advancement of Learning'	Pages 41 to 62 of Spencer, *or* 'Quick,' Chapter XVI.	Deductions on Euclid, Book II., *or* Hedge-tear and Cross-cut Darns	Paraphrase Lines 126 to 138 of 'Macbeth,' Act III., Scene 1, *or* Lines 11 to 23 of 'Hamlet,' Act III., Scene 3	The Half-time Register and 'Form IX.'	Deductions on Euclid, Book I., *or* Write down Directions for Making a Woman's Nightdress	Analyse lines 75 to 83 'Macbeth,' Act III., Scene 4, *or* Lines 53 to 65, 'Hamlet,' Act III., Scene 4. Parse difficult words
TUESDAY	Chief Dates from 1527 to 1588 *or* Revision	Continued Fractions, *or* Stocks	As in First Year — General Physical Geography of England.	History as in First Year, *or* From 1509 to 1532.	Discount and Present Worth	As in First Year — Commercial Geography of England.	Rewards and Punishments; Emulation and Example	Stocks	As in first Year — Political Geography of England	History as in First Year, *or* Lives of Warriors from 1485 to 1547	Proofs of Fractional Operations	As in First Year — Physical Geography of Scotland
WEDNESDAY	Analyse lines 13 to 26 of 'Macbeth,' Act III., Scene 2, *or* Lines 376 to 387, 'Hamlet,' Act III., Scene 2. Parse difficult words	Binomial Theorem *or* Bread and Paste Making	English Composition from the 'The Witches' in Macbeth, *or* 'The Ghost' in Hamlet	Read Lecture VI., *or* Notes on 'Hamlet'	Notes of a Lesson on Simple Analysis to Standard V., *or* On the Square (for Infants)	Binomial Theorem *or* Puddings for the Sick	Mensuration, *or* Any Revision	Logarithms, *or* How to Detect Food Adulteration	Chief Dates from 1588 to 1640, *or* Social History from 1485 to 1547	Jevons' Logic, pp. 22 to 37	Algebraic Ratio and Proportion *or* Utilisation of Scraps of Food	Any Geography
THURSDAY	History from 1688 to 1714, *or* History from 1485 to 1509	Problems on the Work of Mixed Agents	As in First Year — Political Map of Australia	History from 1714 to 1760, *or* From 1532 to 1547	Equation of Payments	As in First Year — Geography of Australia.	History from 1760 to 1790, *or* Lives of Statesmen from 1485 to 1547	Averages	As in First Year — Map of New Zealand	History from 1790 to 1815 *or* Religion and Legislation from 1485 to 1547	Surds, *or* Compound Proportion	As in First Year — Geography of Ireland
FRIDAY	Binomial Theorem *or* Diet for Convalescents	Euclid, Book VI., first 5 Props., *or* Diagram of a Woman's Nightdress	Ventilation and Water-supply of School Premises	Roots of Quadratics, *or* Proper Seasons for the various meats	Euclid, Book VI. first 11 Props., *or* Cutting-out of a Child's Muslin Pinafore	Drawing	Logarithms, *or* Ordinary Beverages	Euclid, Book VI., first 17 Props., *or* Making of a Child's Muslin Pinafore	Read Lecture IV., *or* 'Advancement of Learning'	Algebraic Surds *or* Symptoms of the Ordinary Diseases	Euclid's Def. Axioms, etc., of first 6 Books, *or* Making of a Child's Muslin Pinafore	Paraphrasing Composition, *or* Grammar from Text-Book.
SATURDAY.	Drawing	Science	Examination	Music as in First Year	Science	Examination	Music as in First Year	Examination	Paraphrasing (see Article)	Music as in First Year	Examination	Repetition, Literature, and Penmanship

9. Draw a physical map of China.

10. Describe the chief plateaux of Asia,

11. Narrate the principal events of Elizabeth's struggle with Spain.

12. (*Men only.*) What were the causes and chief incidents of the American War of Independence?

(*Women only.*) When were the battles of Navarette, Shrewsbury, Blackheath, Flodden, Pinkie, and Dover fought?

13. What sum of money due 1 year hence is equivalent to £100 due now, together with £300 due 2 years hence, interest being reckoned at 5 per cent per annum? Ans. £391 7s. 3d.$\frac{3}{11}$.

14. (*Men only.*) Find the G.C.M. of $6a^4 + 5a^3b - 10a^2b^2 + 7ab^3 - 2b^4$ and $12a^5 + 7a^4b + 3a^3b^2 - 4a^2b^3 + 5ab^4 - b^5$.

Ans. $3a^2 - 2ab + b^2$.

(*Women only.*) Is clean water always fit to drink? What may water contain which is dangerous to health? How can you test water for (1) lead, (2) lime, (3) sewage? Why is hard water expensive in washing clothes? How can it be softened in large quantities?

15. (*Men only.*) Simplify $\left\{\left(a^{\frac{3}{2}}a^{\frac{1}{2}} \div a^{\frac{1}{2}}\right)^2\right\}^3$ Ans. a^6

(*Women only.*) What are silk, cotton, and wool, and what are the chief merits of each material? How ought woollen garments to be washed?

16. (*Men only.*) A rectangular field contains 1¼ acres. The distance between opposite corners is 6½ chains. Find the length and breadth. Ans. 132 yds., 55 yds.

17. (*Men only.*) Write out Euclid III. 13.

Describe a circle with a given centre which shall touch a given circle. How many such circles can be drawn?

(*Women only.*) Give full receipts for six nourishing and inexpensive dishes for a labouring man's dinner, his family consisting of himself, wife, and three children of school age. State the cost of each.

18. (*Men only.*) Write out Euclid I. 40.

If a quadrilateral is bisected by both its diagonals it is a parallelogram.

THIRD WEEK.

1. Write in Large-hand the words '*Fashionably Attired.*'
Write in Small-hand the lines :—

'*In full-blown dignity see Wolsey stand,*
Law in his voice and fortune in his hand.'

2. Write from Dictation :—

'By considering the great thinkers in chronological order, we see that each adds to the treasure which he finds already accumulated, and thus by degrees we are arriving in education, as in most departments of human endeavour, at a science. In this science lies our hope for the future. Teachers must endeavour to obtain more knowledge of the laws to which their art has to conform itself.'

3. In criticising a lesson given by a teacher, what are the special points to which attention should be directed? Give some rules, as to Pupil-Teachers, to help them in judging of merits and defects, and in forming a just estimate of the success of a lesson.

4. What is the difference between voluntary and involuntary attention? Give some examples of both, and of the conditions under which the power of fixing and concentrating the attention of scholars may best be strengthened.

5. Write down notes to show the following major scale relations :—
Mediant in Key of F ; *Leading-note* in Key of D ; *Subdominant* in Key of B♭ ; *Submediant* in Key of A ; *Dominant* in Key of E♭, and *Supertonic* in Key of A♭.

6. Write out in proper time the melody of any *well-known* hymn-tune or song.

7. Write a brief essay upon '*Nature works mightier deeds in calm than rage.*'

8. Analyse the following lines and parse the words in italics :—

(*Men only.*)
The *mother's* eye
Full of the wistful fear *that* he *would go*,
And *turning* towards him *wheresoe'er* he turned
Perplexed his outward purpose, *till* an *hour*,
When wakened by the wind *which* with full voice
Swept *bellowing* thro' the darkness on to dawn,
He rose.

(*Women only.*) *What though* the field *be lost?*
All is not lost—the unconquerable will,
And *study* of revenge, immortal hate,
And courage *never* to submit or *yield*,
And *what* is *else* not *to be overcome*;
That *glory* never shall his wrath or might
Extort from me.

9. A telegram leaves Bombay at 10 a.m., and occupies 4¾ hours in transmission. At what hour (Greenwich time) will it reach London, the longitude of Bombay being 72°53'?

10. Write notes of a lesson on the chief races of Asia.

11. Mention the chief events connected with York *or* Oxford.

12. Give the dates of execution of Gaveston, Mortimer, Lord Hastings, Empson, Ket, Wyatt, and Mary, Queen of Scots.

13. At what times between five and six o'clock, are the hands of a watch at right angles? Ans. $10\frac{10}{11}$ mins. past five, and $43\frac{7}{11}$ mins. past five.

14. (*Men only.*) $\frac{x^2 - 16y^2}{x^2 - xy - 12y^2} \times \frac{x^2 - 9y^2}{x^2 + xy - 12y^2}$. Ans. 1.

(*Women only.*) A man's diet each day is as follows :—Bread, butter, milk, bacon, potatoes, cabbage, cheese, sugar, salt, and water. Say what you know of the nutritive effect of each of these substances. What kind of difference would it make if he took no cheese and substituted more potatoes?

15. (*Men only.*) Prove that $\frac{a - 7a^{\frac{1}{2}}}{a - 5\sqrt{a} - 14} \div \left(1 + \frac{2}{\sqrt{a}}\right)^{-1} = 1$.

(*Women only.*) Name some foolish fashions in women's dress, and show they may injure the health and interfere with the comfort of those who adopt them.

16. (*Men only.*) If the sides of a right-angled triangle are in A.P. to what numbers are they proportional?

17. (*Men only.*) Write out Euclid III., 18.

Draw a common tangent of two given circles.

(*Women only.*) Write Notes of a Lesson on the 'Management of a Sick-room.'

18. (*Men only.*) Write out Euclid I. 48.

Prove this Prop. from Euclid II. 4.

CORRESPONDENCE.

We shall be pleased to reply briefly and through these columns to any SUBSCRIBER *seeking examinational information or advice, and* ENCLOSING THE NECESSARY COUPON.

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H. P. (Skipton), Galbraith and Houghton 3s. 6d., Cassell.

J. W. (Stoneycroft.) (1) Yes; English, Geography and History, and Science. (2) One Advanced and Two Elementary are allowed. (3) You will *by this time* have heard from Department.

MODEL ANSWERS TO PUPIL TEACHERS' MATHEMATICS OF EXAMINATION 15th APRIL 1893.

FIRST YEAR.

BOYS ONLY.

ARITHMETIC.

(*Answer three Questions, including the first if you can.*)

1. (*a*) Find the largest number that will divide both 123 and 147 without a remainder; and find also the smallest number which can be divided exactly by each of the above two numbers.

(*b*) Show whether 353 is a prime number or not.

(*c*) The hind and front wheels of a carriage are 8 and 12 feet in circumference respectively. What is the least distance over which the carriage must travel, so that each wheel may have made a complete number of revolutions?

(*a*) i. $123 = 3 \times 41$; and $147 = 3 \times 7 \times 7$,
but 41 is not divisible by 7;
$\therefore$ 3 is the G.C.M. Ans.

ii. L.C.M.
3 | 123 — 147
41 — 49
$3 \times 41 \times 49 = 6027$. Ans.

(*b*) $19 \times 19 = 361$. Now as 361 is > 353, *one* of its factors (if 353 be not prime) will be less than 19.

Secondly. 353 is odd, and $\therefore$ is not divisible by 2, 4, 6, 8, 10, 12, 14, 16, 18.

Thirdly. $(3 + 5 + 3)$ is not divisible by 3, $\therefore$ 353 is not divisible by 3, 6, 9, 12, 15, 18.

Fourthly. 353 does not terminate in 5 or 0, $\therefore$ 353 is not divisible by 5, 10, 15.

Fifthly. $\{(3 + 3) - 5\}$ is not divisible by 11, $\therefore$ 353 is not divisible by 11.

Sixthly. It only remains to show *by trial* that 353 is not divisible by 7, 13, 17.

$\therefore$ 353 is prime. —Q. E. D.

(*c*) Any wheel makes one revolution whilst travelling the length of its circumference,

$\therefore$ L.C.M. of 8 feet and 12 feet = 24 feet is the Ans.

2. (*a*) Prove that $\frac{2}{3}$ of one unit is equal to $\frac{1}{3}$ of three units.

(*b*) What fraction of 10 miles is $\frac{3}{5}$ of $\frac{5}{7}$ of 18 yards?

(*a*) $\frac{1}{3}$ of three units = $\frac{1}{3}$ of 1 unit + $\frac{1}{3}$ of 1 unit + $\frac{1}{3}$ of 1 unit = $\frac{2}{3}$ of 1 unit. —Q. E. D.

This can also be *illustrated* by showing that $\frac{2}{3}$ of one inch = $\frac{1}{3}$ of 3 inches; or that $\frac{2}{3}$ of one crown = $\frac{1}{3}$ of three crowns.

(*b*) $$\frac{\frac{3}{5} \times \frac{5}{7} \times \frac{1}{2}^{8} \text{ yds.}}{10 \text{ miles}} = \frac{\frac{3}{5} \times \frac{5}{7} \times \frac{1}{2}^{8}}{\frac{17600}{1}} = \frac{2}{3} \times \frac{5}{7} \times \frac{18}{1} \times \frac{1}{17600}$$

$$= \frac{18}{3 \times 1760 \times 7} = \frac{6}{1760 \times 7} = \frac{3}{880 \times 7} = \frac{3}{6160}. \text{ Ans.}$$

3. If A owns ·58 of a ship, and B owns the rest; and if the difference in the money value of their shares is £37·46, what is the value of the ship?

A owns ·58 ship, $\therefore$ B owns (1 — ·58) ship = ·42 ship,
$\therefore$ fractional difference of shares = (·58 — ·42) = ·16.
But ·16 ship = £37·46,
$\therefore$ ·01 ship = £2·34125,
$\therefore$ ship = £2·34125 × 100 = £234·125 or £234 2s. 6d. Ans.

4. Add together 21·75 of 7s. 6d., ·3625 of 10s., and 13·75 of 1s.

21·75 of 7s. 6d. + ·3625 of 10s. + 13·75 of 1s. =
21·75 × 90d. + ·3625 × 120d. + 13·75 × 12d. =
1957·5d. + 43·5d. + 165d. =
2166d. = 180s. 6d. = £9 0s. 6d. Ans.

5. Simplify $\frac{1\frac{1}{2} + 8\frac{2}{5}}{6\frac{3}{4} + 2\frac{17}{30}} - \left\{ 9\frac{1}{3} \div 4 \left(5\frac{5}{6} \text{ of } 1\frac{1}{5} \right) \right\}$

$$\frac{\frac{11}{12} + \frac{42}{5}}{6\frac{3}{4} + 2\frac{17}{30}} - \left\{ 9\frac{1}{3} \div 4 \left(5\frac{5}{6} \times 1\frac{1}{5} \right) \right\} =$$

$$\frac{\frac{55 + 504}{60}}{\frac{405 + 154}{60}} - \left\{ \frac{28}{3} \div 4 \left(\frac{35}{6} \times \frac{6}{5} \right) \right\} =$$

$$\frac{559}{559} - \left(\frac{28}{3} \div \frac{28}{1} \right) =$$

$$1 - \frac{1}{3} = \frac{2}{3} \text{ Ans.}$$

6. If we had a coin worth 7½d., how many such coins would be worth 625 francs, one pound sterling being worth 25 francs?

25 francs = £1;
625 ,, = £25 = 500s. = 4000 three-half-pences =
800 required coins.

GIRLS ONLY.

(*Do three Questions only, including Question 6 if you can.*)

1. What must be given for 759 tons at £1 13s. 10d. per ton. [Work this sum by two different methods.]

(*a*) *Multiplication*—

$$759 = 11 \times 69 = 11 \times 3 \times 23.$$

£	s.	d.
1	13	10
		3
5	1	6
		23
116	14	6
		11
1283	19	6 Ans.

(*b*) *Practice*—

		£	s.	d.		£	s.	d.	
		759	0	0	= cost at	1	0	0	per ton.
10s. of £1	= ½	379	10	0	= ,,	0	10	0	,,
3s. 4d. of 10s.	= ⅓	126	10	0	= ,,	0	3	4	,,
6d. of 10s.	= $\frac{1}{20}$	18	19	6	= ,,	0	0	6	,,
		£1283	19	6	= ,,	1	13	10	,, Ans.

2. Find, by practice, the loss of time in 17 days 9 hours 45 minutes, if a watch loses 8 minutes 16 seconds in 6 hours.

Loss in 6 hrs. = 8 mins. 16 seconds.
Loss per day = 33 mins. 4 seconds.

		mins.	secs.		
		33	4	= loss per day.	
		17			
		562	8	= ,,	in 17 days.
6 hrs. of 1 day	= ¼	8	16	= ,, ,, 0 ,,	6 hrs.
3 hrs. of 6 hrs.	= ½	4	8	= ,, ,, 0 ,,	3 ,,
45 mins. of 2 hrs.	= ¾	1	1	= ,, ,, 0 ,,	0 ,, 45 mins.
Answer		575	34	= ,, ,, 17 ,,	9 ,, 45 mins.

3. Make out the following account:—

239 lbs. of tea at 1s. 10d. per lb.
961 lbs. of sugar at 2¾d. per lb.
1½ cwt. of butter at 9½d. per lb.
17 hams at 19s. 10½d. for each ham.

Chestergate, Macclesfield,
15*th April*, 1893.

Mr. Roderick Random,
Dr. to Hooley & Co., Grocers and Provision Dealers.

		£	s.	d.
15th April	239 lbs. of tea @ 1s. 10d. per lb.	21	18	2
	961 lbs. of sugar @ 2¾d. per lb.	11	0	2¾
	1½ cwt. of butter @ 9½d. per lb.	6	13	0
	17 hams @ 19s. 10½d. per ham	16	17	10½
	£	56	9	3¼

4. A man earns 39 shillings per week, and his wife 17 shillings; they pay for rent 7s. 2d. per week, for provisions 15s. 10d. per week; clothing costs annually £11 10s. What do they pay for other expenses, if they are able to save £15 in the year? (52 weeks = one year.)

i. *Annual Income.*
Man, Woman } = (39s. + 17s.) × 52 = £145 12s.

ii. *Annual Outlay for*
Rent, Provisions } = (7s. 2d. + 15s. 10d.) × 52 = £59 16
Clothing = £11 10
Saving = £15 0
Total for R + P. + C. + S. = £86 6

iii. $\therefore$ Other expenses = £145 12 *minus* £86 6 = £59 6. Ans.

5. What number is greater than the sum of $5\frac{11}{12}$ and $6\frac{17}{21}$ by the difference of $6\frac{1}{30}$ and $5\frac{11}{15}$?

$$5\tfrac{11}{12} + 6\tfrac{17}{21} + 6\tfrac{1}{30} - 5\tfrac{11}{15} =$$
$$11\tfrac{33}{28} + \tfrac{83}{21} + 1\tfrac{1}{30} - \tfrac{11}{15} =$$
$$12\tfrac{23}{28} + \tfrac{3}{30} =$$
$$12\tfrac{345}{420} + \tfrac{42}{420} = 13\tfrac{\cancel{387}}{\cancel{420}} \text{ Ans.}$$

6. Define (*a*) multiple, (*b*) common multiple, (*c*) least common multiple, and (*d*) find the least common multiple of 959, 3973, 2329.

(*a*) *A* multiple of a number is a number which contains the first number an exact number of times.

(*b*) *A* common multiple of two or more numbers is a number which contains each of these two or more numbers an exact number of times.

(*c*) *The* least common multiple of two or more numbers is the least number which contains each of these two or more numbers an exact number of times.

(*d*) $959 = 137 \times 7$.
$3973 = 137 \times 29$.
$2329 = 137 \times 17$.
and as 7, 29, 17 are prime, ∴
L.C.M. $= 137 \times 7 \times 29 \times 17 = \underline{472,787}$ Ans.

SECOND YEAR.

Boys only.

Arithmetic.

(*Answer three Questions, including the first, if you can.*)

1. (*a*) Why is the charge per cent. for Life Insurance different for men of different ages, and why different also frequently for men engaged in different occupations?

(*b*) By selling 48 yards at 1s. 8d. per yard, a draper gains 4s., what was the cost price per yard, and what was his gain per cent.

(*c*) In actual trade the percentage of gain is usually calculated on the selling price, what would be the percentage gained, if so calculated, in the above question?

(*a*) i. Elder men must pay more per cent. for they will probably not live to make as many annual payments as younger men.

ii. Different occupations vary in their degrees of salubrity and risk, and thus in the unhealthful and dangerous 'the expectation of life' (as in case i.), and the opportunity of making annual payments is less.

(*b*) Gain on 48 yards = 4s. 0d.
∴ " 1 " = 1d.
∴ Cost per yard = 1s. 7d.
∴ Gain $= \frac{1}{19} = \frac{100}{1900} = \frac{5\frac{5}{19}}{100} = \underline{5\frac{5}{19}}$ p. c. Ans.

(*c*) Gain $= \frac{1}{20} = \frac{5}{100} = \underline{5}$ p.c. Ans.

2. If the work done by a man, a woman, and a boy, be in the proportion of 3, 2, 1; and if 12 men, 15 women, and 15 boys can complete a certain work in 270 days; in what time would 18 men, 12 women, and 12 boys complete it?

i. 12 men = 36 boys; 15 women = 30 boys.
∴ 12m. + 15w. + 15b. = 81 boys.
ii. 18 men = 54 boys; 12 women = 24 boys.
∴ 18m. + 12w. + 12b. = 90 boys.
iii. Time taken by 81 boys = 270 days.
∴ Time taken by 1 boy = 270 × 81 days.
∴ Time taken by 90 boys $= \frac{270 \times 81}{90}$ days $= \underline{243 \text{ days.}}$ Ans.

3. Two men, A and B, have each £1,800 to invest: A invests in a $3\frac{1}{2}$ per cent. stock at 108, and B in a $2\frac{1}{2}$ per cent. stock at 96: compare their incomes from these investments. (Neglect Brokerage.)

A's Income from £108 = £3 15s. 0d.
∴ Income from 1800£ = £3 15s. 0d. × $\frac{1800}{108}$ = £62 10s. 0d.

B's Income from £96 = £2 15s. 0d.
∴ Income from £1800 = £2 15s. 0d. × $\frac{1800}{96}$ = £51 11s. 3d.

∴ A has £10 18s. 9d. more than B. Ans.

4. Find the cost of painting the four sides and the bottom of a tank $3\frac{1}{2}$ yards long, $3\frac{1}{2}$ feet wide, and 6 feet deep, at 4d. per square foot.

Area of bottom $= \frac{21}{2}$ ft. × $\frac{7}{2}$ ft. $= \frac{147}{4}$ sq. ft. $= 36\frac{3}{4}$ sq. ft.

(Circumference of tank = 28 ft.)

Area of sides = 28 ft. × 6 ft. = 168 sq. ft.

∴ Total area to be painted = $204\frac{3}{4}$ sq. ft.

∴ Cost at 4d. per sq. ft. $= \frac{204\frac{3}{4}\text{s.}}{3} = 68\frac{1}{4}\text{s.} = \underline{£3\ 8\text{s.}\ 3\text{d.}}$ Ans.

5. In what time will £275 at 5 per cent. (simple interest) amount to £326 11s. 3d.?

Total Interest = £326 11s. 3d. *minus* £275 = £51 11s. 3d.
Interest for the Year = £13 15s. 0d.
∴ No. of Years $= \frac{£51\ 11\text{s.}\ 3\text{d.}}{£13\ 15\text{s.}\ 0\text{d.}} = \frac{825}{220} = \frac{165}{44} = \frac{15}{4} =$
$\underline{3\frac{3}{4} \text{ yrs.}}$ Ans.

6. Nine fowls are worth five ducks, seven ducks are worth four geese, nine geese are worth seven turkeys, and a turkey is worth 13s. 6d.; how much is a fowl worth?

1 t. $= \frac{27}{2}$ s.; ∴ 7 t. $= \frac{189}{2}$ s.; ∴ 9 g. $= \frac{189}{2}$ s.; ∴ 4 g. $= \frac{4}{9} \times \frac{189}{2}$ s. = 42s.; ∴ 7 d. = 42s.; ∴ 5 d. = 30s.; ∴ 9 f. = 30s.; ∴ one fowl = $\underline{3\text{s.}\ 4\text{s.}}$ Ans.

EUCLID.

Boys Only.

(*Answer two Questions, including Question 3, if you can.*)

1. The angles at the base of an isosceles triangle are equal to one another; and if the equal sides be produced the angles on the other side of the base shall be equal to one another. Euclid. I. 5.

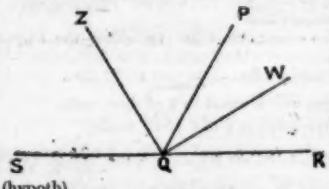
2. Define (*a*) *line*, (*b*) *straight line*. (*c*) To make a triangle of which the sides shall be equal to three given straight lines, but any two whatever of these must be greater than the third.

(*a*) A line is length without breadth.

(*b*) A straight line is that which lies evenly between its extreme points.

(*c*) Euclid I. 22.

3. The angle PQR is bisected; RQ is produced to S, and the angle PQS is bisected. Prove that the two bisecting lines are at right angles.



∠ PQR together with ∠ PQS = 2 right ∠s (I. 13).
but ∠ WQP and ∠ ZQP are half of ∠ PQR and ∠ PQS respectively (hypoth).
∴ ∠ WQP and ∠ ZQP are half of 2 right ∠s (Axiom 1).
∴ ∠ WQP and ∠ ZQP are a right angle, &c.—Q. E. D.

ARITHMETIC.

Girls only.

(*Do three Questions only, including the last, if you can.*)

1. Find the G. C. M. of 27,781 and 23,507, and show that no other number can be their G. C. M.

$27781 = 2137 \times 13$
$23507 = 2137 \times 11$

Now as 13 and 11 are prime 2137 is the greatest common measure.

2. Reduce $\{(\frac{3}{7} \text{ of } 5\frac{1}{4}) + (1\frac{5}{8} \text{ of } 10\frac{4}{7})\} \div 10\frac{4}{7}$ to a simple fraction in its lowest terms.

$$\{(\tfrac{3}{7} \times \tfrac{21}{4}) + (\tfrac{13}{8} \times \tfrac{74}{7})\} \div \tfrac{74}{7} =$$
$$(\tfrac{9}{4} + 16) \times \tfrac{7}{74} =$$
$$\tfrac{73}{4} \times \tfrac{7}{74} = \tfrac{7}{4} = \underline{1\tfrac{3}{4}} \text{ Ans.}$$

3. Reduce (*a*) $\frac{3}{7}$, (*b*) $\frac{13}{11}$, (*c*) $\frac{7}{99}$, (*d*) $\frac{11}{1250}$, to decimal fractions, and (*e*) explain why the first three produce recurring fractions.

(*a*) $\frac{3}{7} = \cdot 428571.$
(*b*) $\frac{13}{11} = 1\cdot\dot{1}\dot{8}.$
(*c*) $\frac{7}{99} = \cdot 07.$
(*d*) $\frac{11}{1250} = \cdot 044.$

(*e*) The first three fractions do not *terminate*, because 7 is not a factor of 10 or any power of ten, but the decimal figures recur, because in due time the same remainders must recur. This causes the same quotient to recur, and therefore the same dividend or decimal figure.

4. Find the value of $\frac{3}{5}$ of 9s. 11d. $+\frac{5}{11}$ of £1 10s. 3d. $-\frac{4}{17}$ of 12s. 9d. $+3\frac{1}{2}$ of £3 19s. 6d.

	£	s.	d.
$\frac{3}{5}$ of	9	11 =	4	3
$\frac{5}{11}$,,	1 10	3 =	13	9
$3\frac{1}{2}$,,	3 19	6 =	13	13	10
Total		= £	14	11	10
$\frac{4}{17}$,, 12s. 9d. =			3	0
∴ Diff. =		£	14	8	10

5. Subtract $\frac{7}{11}$ of 4 tons 13 cwt. 2 qrs. from $\frac{5}{8}$ of 6 tons 15 cwt., and express your answer as a fraction of 30 tons.

$$\frac{\frac{5}{8}\text{ (6 tons—15 cwt.)} - \frac{7}{11}\text{ (4 tons 13 cwt. 2 qrs.)}}{30\text{ tons.}} =$$

$$\frac{\frac{5}{8}\times{}^{8}\!\!\not{4}^{1}0\text{ qrs.} - \frac{7}{11}\times{}^{3}\!\!\not{4}^{1}4\text{ qrs.}}{30\times 80} =$$

$$\frac{300-238}{30\times 80} =$$

$$\frac{62}{30\times 80} = \frac{31}{1200}\text{ Ans.}$$

6. (*a*) Write out the rule for finding the L. C. M. of three or more numbers, and (*b*) find the L. C. M. of 5713, 5771, 6467.

(*a*) *Step* i. Divide as many numbers as possible (at least two) by their least common factor.

Step ii. Repeat the process of Step i. with the quotients thus obtained until the final quotients are prime *to each other*.

Step iii. Multiply all the divisors and final quotients together.

(*b*) 29 | 5713, 5771, 6467
| 197, 199, 223

L.C.M. = 197 × 199 × 223 × 29 = 253525801 Ans.

THIRD YEAR.

BOYS ONLY.

ARITHMETIC.

(*Answer three Questions, including the first if you can.*)

1. Explain the terms (*a*) brokerage, (*b*) consols are at par, (*c*) consols are at a discount.

(*d*) If I sell out £3,000 3½ per cent. stock at 112, and reinvest in a 4½ per cent. stock at 119, how much do I gain in annual income?

(*a*) *Brokerage* is a commission (generally ¼ p.c.) paid to the stockbroker who negotiates the transfer of stock, by the buyer and seller. If stock sells for 96⅝ the seller receives 96⅜ and the buyer pays 97.

(*b*) Consols, or Consolidated Stock, are at *par* when £100 stock will sell for £100 cash.

(*c*) Consols, or Consolidated Stock, are at a discount when £100 stock will not sell for as much as £100 cash.

(*d*) i. First Income = £3½ × 30 = £105.

ii. Second Stock = $\frac{112}{119}\times$ £3000.

iii. Second Income = $\frac{112}{119}\times\frac{£3000}{1}\times\frac{17}{400} = 4\times$ £30 = £120.

iv. Difference of Income = £120 *minus* £105 = £15 Ans.

2. A circular race-path is 1078 yards round; A and B start, back to back, to run round it; the one runs at the rate of 12 miles and the other at 12½ miles an hour; when and where will they first meet?

Joint speed 24½ miles per hour.

Time taken to run 1 yard = $\frac{60\text{ mins.}}{\frac{49}{2}\times\frac{1760}{1}}$

Time taken to run 1078 yards = $\frac{60\times 2\times 1078}{49\times 1760}$ mins. = 1½ mins.

Distance run by A in 1 hour = 12 miles.

Distance run by A in 1½ hour = $\frac{12}{40}$ mile = $\frac{3}{10}$ mile = 528 yards.

Ans. 528 and 550 yards from start; 1½ minutes.

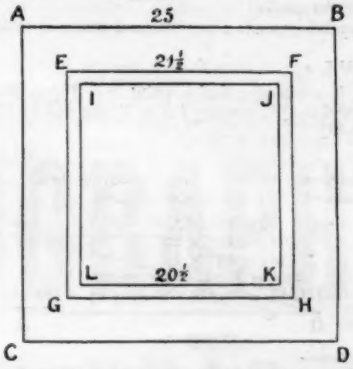
3. In a certain examination every candidate was allowed to take either the Language Paper, or the Science Paper, or both: 75·6 per cent. took the Language Paper; and 87·4 per cent. took the Science Paper: there were 1700 candidates: how many took both papers?

24·4 per cent. omitted the Language Paper, and took the Science Paper only.

∴ No. taking both Papers = 87·4 *minus* 24·4 = 63 per cent.

63 per per cent. on 1700 = 63 × 17 = 1071 Ans.

4. In a room 25 feet square, a carpet 21½ feet square was laid down, leaving an even margin: the margin was covered by an oil-cloth which reached 6 inches underneath the carpet all round: the oil-cloth cost 3s. per square yard, and the carpet 6s. per square yard: what was the whole cost?



i. Area of outmost square = 25 × 25 square ft. = 625 square ft.

Area of inmost square = 20½ × 20½ sq. ft. = $\frac{1681}{4}$ sq. ft.

∴ Area of oil-cloth = 625 *minus* $\frac{1681}{4}$ = 204¾ sq. ft.

∴ Cost of oil-cloth = $\frac{819}{4\times 9}\times$ 3s. = £3 8s. 3d.

ii. Area of carpet square = $\frac{43}{2}\times\frac{43}{2}$ sq. ft. = $\frac{1849}{4}$ sq. ft.

∴ Cost of carpet square = $\frac{1849}{4\times 9}\times$ 6s. = $\frac{1849}{6}$ s. = 308s. 2d.

£15 8s. 2d.

iii. ∴ Total cost = £3 8s. 3d. + £15 8s. 2d. =
£18 16s. 5d. Ans.

5. A, B, and C together fill a pit in 2½ hours, throwing in respectively 7, 12, and 14 shovelfuls of earth per minute: in what time would each man have filled up the pit by himself?

i. Total shovelfuls per minute = 33.

or ,, in 2½ hours } = 33 × 150 = 4950.
,, pit }

ii. Time taken by A to throw 7 shovelfuls = 1 minute.

∴ ,, ,, ,, 4950 ,, = $\frac{4950}{7}$ minutes =
707⅐ min. = 11 hrs. 47⅐ mins. Ans.

iii. Time taken by B to throw 4950 shovelfuls = $\frac{4950}{12}$ minutes =
412½ mins. = 6 hrs. 52½ mins. Ans.

iv. Time taken by C to throw 4950 shovelfuls = $\frac{4950}{14}$ minutes =
353⅐ mins. = 5 hrs. 53⅐ mins. Ans.

6. Having bought £40 worth of goods, I sell half at a gain of 10 per cent.: for how much must I sell the remaining half so as to gain 30 per cent. on the whole?

1st method—

i. First £20 worth sells for £20 + $\frac{1}{10}$ of £20 = £22.

ii. Selling price of whole to gain 30% = £40 + $\frac{3}{10}$ of £40 = £52.

iii. ∴ Price of second £20 worth = £52 *minus* £22 = £30. Ans.

2nd method—

30% on whole = 60% on half.

But only 10% has been gained on first half.

∴ 50% must be gained on second half.

∴ £20 + 50% of £20 = £30. Ans.

EUCLID.

BOYS ONLY.

(*Answer two Questions, including Question* 3, *if you can.*)

1. (*a*) Define *parallel straight lines*. (*b*) If a straight line falling on two other straight lines make the alternate angles equal to one another, the two straight lines shall be parallel to one another.

(*a*) Parallel straight lines are straight lines which are in the same plane, and which do not meet however far produced.

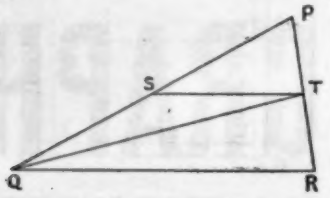
(*b*) Euclid I. 27.

2. (*a*) Define *parallelogram*. (*b*) The complements of the parallelograms which are about the diameter of any parallelogram are equal to one another.

(*a*) A parallelogram is a quadrilateral whose opposite sides are parallel.

(*b*) Euclid I. 43.

3. PQR is a triangle; find a point S in PQ so that if ST be drawn parallel to QR, meeting PR in T, the sum of PS, ST shall be equal to PQ.



Construction—
Bisect ∧ PQR by line QT meeting PR in T.
Draw TS ‖ to QR
Then S is the point required.

Proof—
∵ ST is ‖ to QR ∴ ∧ STQ = ∧ TQR (I. 29).
But ∧ TQR = ∧ SQT (Construction).
∴ ∧ STQ = ∧ SQT (Axiom 1).
∴ SQ = ST (I. 6).
∴ SQ together with SP = ST together with SP (Axiom 2).
∴ PQ = the sum of PS, ST. —Q. E. F.

ALGEBRA.

BOYS ONLY.

(*Answer three Questions, including Question 4, if you can.*)

1. If $x = 1$, $y = -2$, $z = 3$, $w = -4$, find the value of $\frac{x^2y^2 + y^2z + w(x-y)}{10x - (z+y)^2}$

$$\frac{x^2y^2 + y^2z + w(x-y)}{10x - (z+y)^2} = \frac{4 + 12 - 4 \times 3}{10 - 1} = \frac{4}{9} \text{ Ans.}$$

2. Resolve into factors—
(*a*) $3a^2 + 23a + 14$; (*b*) $c^2 - a^2 - b^2 + 2ab$;
(*c*) $(3a + 2b + c)^2 - (a + 2b + 3c)^2$.

(*a*) $3a^2 + 23a + 14 = (3a + 2)(a + 7)$.
(*b*) $c^2 - a^2 - b^2 + 2ab = (c + a - b)(c - a + b)$.
(*c*) $(3a + 2b + c)^2 = (a + 2b + 3c)^2 = 8(a + b + c)(a - c)$.

3. (*a*) Solve the equation $\frac{2(x-3)}{7} - \frac{5(x+5)}{8} + 5\frac{19}{28} = 0$.

(*a*) $\frac{2(x-3)}{7} - \frac{5(x+5)}{8} + \frac{159}{28} = 0$.

Multiply both sides by 56.
$16x - 48 - 35x - 175 + 318 = 0$.
$19x = 95$
$x = \underline{5}$ Ans.

(*b*) Out of a cask of wine, of which a fifth part had leaked away, 10 gallons were drawn, and then the cask was two-thirds full. How much did it hold?

Let x galls. = capacity of cask.
$\therefore \frac{4}{5}x - 10 = \frac{2}{3}x$.
$12x - 150 = 10x$.
$2x = 150$.
$x = \underline{75 \text{ galls.}}$ Ans.

4. (*a*) Why is the name 'highest common factor' preferable in algebra to 'greatest common measure'? (*b*) Prove that if two expressions have a common factor, it will divide the sum of any multiples of them.

(*c*) Find the H.C.F. of $a^3 - a^2 - a + 1$, $3a^2 - 2a - 1$, and $a^3 - a^2 + a - 1$.

(*a*) In Algebra we deal with *general* expressions, and it would be sometimes possible by assigning particular values to obtain a *numerical* Greatest Common Measure which would be larger than the *algebraical* Highest Common Factor.

Thus the H. C. F. of $x^2 + x$ and $7x$ is x, but by taking $x = 6$ the G. C. M. = 42.

(*b*) Let x and y be two expressions having the common factor p, so that $x = ap$, and $y = bp$; and let mx and ny be any multiples of x and y respectively; then p will divide $mx + ny$.

Proof—
$\because x = ap \therefore mx = map$.
$\because y = bp \therefore ny = nap$.
$\therefore mx + ny = (ma + na)p$
$\therefore \frac{mx + ny}{p} = ma + na$ Q.E.D.

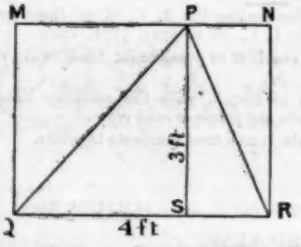
(*c*) $a^3 - a^2 - a + 1 = (a + 1)(a - 1)(a - 1)$.
$3a^2 - 2a - 1 = (3a + 1)(a - 1)$.
$a^3 - a^2 + a - 1 = (a^2 + 1)(a - 1)$.
$\therefore \underline{a - 1 = \text{H.C.F.}}$ Ans.

MENSURATION.

BOYS ONLY.

(*Answer one Question.*)

1 (*a*) Prove that the area of a triangle whose base is 4 feet, and whose altitude is 3 feet is 6 square feet.



(*b*) Find the area in acres of a triangle whose sides are 15, 20, 25 chains.

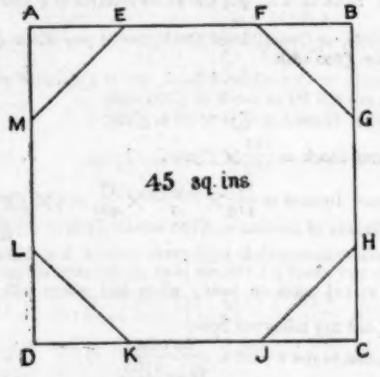
(*a*) *Proof*—
By Euclid I. 41 △ PQR
= ½ rect. MNRQ
= ½ of 4 feet × 3 ft.
= 6 sq. ft.

(*b*) Area = $\sqrt{s(s-a)(s-b)(s-c)}$ where a, b, c, s are the sides and half the sum of the sides respectively.

$\therefore s = 30$, $a = 15$, $b = 20$, $c = 25$.

$$\text{Area} = \sqrt{30 \times 15 \times 10 \times 5} = \sqrt{5 \times 3 \times 2 \times 5 \times 3 \times 5 \times 2 \times 5}$$
$$= \sqrt{25^2 \times 3^2 \times 2^2} = 150 \text{ sq. chains} = \underline{15 \text{ acres.}} \text{ Ans.}$$

2. A square whose area is 45 square inches has its sides trisected, and the nearest points of trisection joined so as to cut off its corners; find the area of the resulting octagon.



Squares on AE, etc. are each $\frac{1}{9}$ of sq. on AB
$\therefore$ △s AEM, etc. are each $\frac{1}{18}$ of sq. on AB
$\therefore$ space of square outside octagon = $\frac{4}{18} = \frac{2}{9}$ of 45 sq. ins.
= 10 sq. ins.
$\therefore$ Octagon = $\underline{35 \text{ square inches.}}$ Ans.

ARITHMETIC.

GIRLS ONLY.

(*Do three questions only, including the last, if you can.*)

1. Reduce 404 acres 1 rood 23 poles to the fraction of 413 acres 1 rood 37 poles in its lowest terms.

$$\frac{404 \text{ a. } 1 \text{ r. } 23 \text{pl.}}{413 \text{ a. } 1 \text{ r. } 37 \text{pl.}} = \frac{64703}{66157} = \frac{89}{\underline{91}} \text{ Ans.}$$

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2. If 357 hams, each weighing 19 lbs., can be bought for £399, how many hams weighing 17 lbs. can be bought for £210?

As 17lbs. : 19lbs. :: 357 hams : x
£399 : £210 ::

$$\therefore x = \text{hams } \frac{357 \times 19 \times 210}{17 \times 399} = \underline{210 \text{ hams.}} \quad \text{Ans.}$$

3. (*a*) Divide 66·761 by ·0661; (*b*) divide ·047 by ·0021 correctly to three places of decimals.

(*a*) $\frac{66 \cdot 761}{\cdot 0661} = \frac{667610}{661} = \underline{1010}$ Ans.

(*b*) ·0021) ·04700000 (22·3809 +

42
50
42
80
63
170
168
200
189
11

Ans. 22·381 nearly.

4. A man leaves to two of his daughters $\frac{5}{13}$ and $\frac{8}{11}$ of his property respectively, and the remainder to a third; the first had for her share £12,507, what would the third have?

(i) Share of third daughter $= 1 - (\frac{5}{13} + \frac{8}{11}) =$

$$1 - \frac{55+39}{143} = 1 - \frac{94}{143} = \frac{49}{143}$$

(ii) If $\frac{94}{143}$ = £12507 what is $\frac{49}{143}$ worth?

$$\frac{£12507}{1} \times \frac{49}{55} = \frac{£1137 \times 49}{5} = \frac{£55713}{5} = \underline{£11142\ 12s.} \quad \text{Ans.}$$

5. Find the value of ·025 of £3 5s. + ·07 of £2 1s. 3d. + ·053 of £1 0s. 7½d. + ·675 of 15s.

	£	s.	d.
·025 of £3 5s. 0d.	= 0	1	7½
·07 of £2 1s. 3d.	= 0	2	11
·053 of £1 0s. 7½d.	= 0	1	1½
·675 of £0 15s. 0d.	= 0	10	1½
Total	= 0	15	9½ Ans.

6. (*a*) Define ratio and proportion, and (*b*) show by the use of fractions that if four numbers are proportional, the product of the extremes is equal to the product of the means.

(*a*) i. *Ratio* is the the mutual relation of two magnitudes of the same kind to each other with respect to quantity. It is often expressed by a fraction. The ratio of 3 to 7 is 3 : 7 or $\frac{3}{7}$.

ii. *Proportion* is the equality of ratios. Thus 3 : 7 :: 6 : 14 or $\frac{3}{7} = \frac{6}{14}$.

(*b*) If 3 : 7 as 6 : 14, the $3 \times 14 = 7 \times 6$, for whatever number of times or fraction 6 is of 3 (by the theory of fractions) 14 must be of 7.

If $\frac{a}{b} = \frac{c}{d}$ then $\frac{c}{d} = \frac{ma}{mb}$

$ad = abm$
$bc = abm.$

Q.E.D.

SCIENCE NOTES.

MOISSAN'S MANUFACTURE OF DIAMONDS.—As early as the year 1880, Hannay succeeded in obtaining diamond-like crystals by heating a mixture of paraffin oil with lampblack, bone oil, and some lithium in an iron tube under high pressure. In the same year Marsden obtained minute black diamonds, or carbonados, by a different process—that of heating silver with sugar charcoal. Now a French chemist, M. Henri Moissan, has very recently succeeded in manufacturing colourless diamonds by processes which are of great scientific interest. His method of attaining this result is founded on the capacity possessed by iron of absorbing carbon at a high temperature, and of giving it back in the shape of grains and crystals while the iron mass is cooling. In the course of Moissan's experiments, a hollow cylinder of soft iron was first filled with purified sugar charcoal, and then corked with an iron screw. About half a pound of soft iron was then made molten in a crucible in the French scientist's new electric furnace, which readily gives a temperature of 54,000° Fahrenheit. On plunging the cylinder into the molten metal, the iron became thoroughly saturated with carbon. The crucible was then removed from the furnace, and plunged into a pail of cold water, where it remained till the surface of the iron mass was cooled to a dull red heat, when it was taken out and left to cool in the air. The effect of the sudden immersion in cold water was to form an outer solid crust to the iron mass, thus preventing its further expansion, and securing its solidification under immense pressure. The separation of the iron from the carbon crystals it might contain was then accomplished by dissolving the iron in hydrochloric acid. Three different varieties of carbon crystals—graphite, chestnut-coloured curved needles, and diamond dust—were received as a residue. A few minute diamonds obtained were translucent, scratched a ruby, and distinctly showed under the microscope the crystalline structure and the cleavage of the diamond. Their density was that of the precious stone, and they were completely consumed in oxygen at a temperature of 1,890°.

***

A NEW ELECTRIC FURNACE.—The electric furnace used by M. Moissan in his experiments for the liquefaction of iron has been the means of giving to the world results in high temperatures as interesting and full of promise for the future as those attained by Pictet and Dewar at the other end of the thermometric scale. It consists of two superposed bricks made of quicklime or of an especially pure calcinated magnesia. A groove with a small cavity in the middle—large enough to receive a small crucible—is made on the upper face of the lower brick, and two carbon electrodes are introduced from both sides into the groove. As soon as they are connected with a dynamo-machine, the electric arc appears between their extremities. An immensely high temperature is thus produced in the cavity. While a small Edison machine worked by a gas engine of eight-horse power is estimated to give a temperature of about 45,000° Fahrenheit, a fifty-power engine will produce the enormous temperature of 54,000° Fahrenheit. The results of these high temperatures are very noteworthy. At about 45,000° Fahrenheit lime, strontia, and magnesia were crystallised in a few minutes, while at 54,000° Fahrenheit the oxides of various metals formerly considered irreducible—nickel, cobalt, manganese, and chrome oxides—were rapidly deprived of their oxygen. Pure aluminium was fused and little rubies formed at a temperature of 40,500°, and with greater heat the aluminium was volatilised.

***

SULPHUR IMPRESSIONS.—A curious discovery—that of the power of sulphur to receive impressions—has lately been accidentally made by a French scientist. M. Lepirre, while experimenting with melted sulphur at a temperature of about 150°, was desirous of showing that it is capable of being cooled on paper. For this purpose he used a lithographed card. When the card was removed, it was discovered that the characters impressed upon it were very clearly and accurately reproduced upon the cooled surface of the sulphur. Both rubbing and washing were resorted to with the view of removing the impressions, but without effect. In the course of further experiments it was shown that these impressions could readily be made on sulphur from designs made in almost every ordinary way by pencil, crayon, or ink. Coloured inks gave especially favourable results. It is hoped that this discovery of M. Lepirre may prove to be of considerable value in the arts.

***

THE INFLUENCE OF CLIMATE ON COLOUR.—An interesting illustration of the influence exerted by climate on colour is afforded by some recent observations on the rabbits kept at the Pic du Midi Observatory, 9,500 feet above the sea level. In the space of seven years, a race had been produced differing in several particulars from their congeners of the surrounding plains. They are a little smaller, with less developed ears, and their fur, while lighter in colour, is very thick. Their blood, too, contains more iron and has a greater power of absorption for oxygen than that of the rabbits of the plains. J. R. G.

ERROR PRIZE.—A P.O.O. for 10s. 6d. has been remitted to Mr. H. C. Steddy, 6, Boxworth Grove, Barnsbury, London, N., who was the first to point out an error in the Supplement presented with our last issue.

Owing to the great pressure on our space this month, we are compelled to hold over until next issue the following contributions:—Sketches of Modern Educational Reformers; Teachers' Drawing Lessons; Notes and Notions; Query Column, and several Reviews.

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